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THE

PRINCIPLES OF SURGERY,

AS THEY RELATE TO

WOUNDS, ULCERS, FISTULÆ, ANEURISMS,

WOUNDED ARTERIES,

FRACTURES OF THE LIMBS, TUMORS,

THE OPERATIONS OF TREPAN AND LITHOTOMY.

ALSO OF

THE DUTIES

OF THE

MILITARY AND HOSPITAL SURGEON.

BY JOHN BELL.

A NEW EDITION,

WITH

COMMENTARIES, AND A CRITICAL ENQUIRY INTO THE PRACTICE
OF SURGERY.

BY CHARLES BELL,

PROFESSOR OF ANATOMY AND SURGERY TO THE ROYAL COLLEGE OF SURGEONS IN
LONDON, SURGEON OF THE MIDDLESEX HOSPITAL, ETC.

IN FOUR VOLUMES.

WITH ENGRAVINGS AND MARGINAL ILLUSTRATIONS.

VOL. I.

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PREFACE.

Of those Members of the Medical Profession who have been educated under Mr. John Bell, and who have studied his works, many have been distinguished by great zeal, and all have but one opinion on his merits. They acknowledge the admirable capacity he had for teaching, as well as the correctness and importance of the principles which he taught. It is, therefore, much to be regretted that any thing should have limited the influence of his works on the general profession; and there cannot be a doubt that the expensive mode of their publication, and the diffuse style of composition, have had this effect. It has been my object, in re-publishing these volumes, to retain all the important practical matter,—to preserve, also, the admirable introductions, as well as the lively and ingenious illustrations. But in the original edition, the work was loaded with notes, containing long Latin quotations, and unnecessarily encumbered with excerpts from obsolete French works. These were often but a less perfect version of what was delivered in the text, and I have not hesitated to expunge them. I may be considered as less excusable in omitting certain portions of dissertations which possessed all the peculiar merit of Mr. John Bell's writings, but which did not appear to me to be essential. I had long observed with regret, that the admirable lessons contained in these works were to be got at with too much expense and labour, and that they were thus lost to the practising part of the profession. It was necessary to present them in a less voluminous form, and the value of the practical matter made it the more incumbent to omit some portions. With these exceptions, the reader will find the whole of Mr. John Bell's surgical works in these four volumes.

I have occasionally introduced a Commentary, sometimes in illustration of the author's meaning, sometimes to vindicate his merit or originality; and on some subjects I have given additional Notes, to bring up the history of opinions to the present day.

It is with great satisfaction that I present to the Profession an Edition of Mr. John Bell's Works; and, did it not sound like vanity, I would express a wish that the contents of these volumes may prove to the reader of the same value that the lessons of a brother have been to me.

Note.—To some of the commentaries made by Mr. Charles Bell, the initials C. B. are added, but in the greater number these letters have been omitted.

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A
SHORT PRELIMINARY DISCOURSE
ON THE
EDUCATION AND DUTIES OF A SURGEON.

I AM now entering, Gentlemen, upon a course of Surgery, which will be of little service to you, unless I lead you onwards, by gradual steps, from theory to practice; from the common principles of surgery, and the most ordinary duties of the surgeon, to those important operations which it is sometimes our duty to perform. In every profession, the daily and common duties are the most useful; and in ours, the man who is capable of the great operations rises into public esteem, only because it is presumed that he who is the most capable in the higher departments of his profession will best perform all its ordinary duties.

Yet such is the natural horror at blood, and the hesitations and difficulties of the surgeon himself, when any thing so daring as a dangerous operation is to be done, and such are the unceasing and anxious inquiries of friends, that operations, though the least part of our profession, strike a deeper interest into the public mind than the daily cures we perform. Operations usurp an importance in surgical education which they should not naturally have. Operations have come at last to represent, as it were, the whole science; and a surgeon, far from being valued according to his sense, abilities, and general knowledge, is esteemed excellent only in proportion as he operates with skill.

On a future occasion, I shall have much to say to you on this very subject; at present, it is more natural, I believe, to offer you some rules, not for the practice of your profession, but for the study of it: for if you study with real diligence, according to a sensible plan, those good dispositions will naturally grow up, which every friend, which every teacher would wish you to cherish; you will feel a generous disregard of every thing but opportunities of doing good, and promoting, to the utmost of your power, the interests of humanity, of your profession, and of general science. From the cause of science never allow yourselves to be separated by any selfish or partial views. From the day in which you devote yourselves to a profession which brings with it indescribable cares and difficulties, never cease to think how you are to support its interests, and to contribute, each of you in his own private station, to make the profession honourable as well as useful. Such is the connexion of every individual with the art or science to which he belongs, that were his profession generally despised, his most honourable exertions would be of no avail. It is surely then no affectation to say, that I take the most sincere interest in your studies, your success, and your honourable conduct in the world *.

It was an enthusiastic desire of learning his profes-

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* My brother gives here a long and animated recommendation to his pupils to enter into the public service. I preserve only his eloge of Ambrose Paré, born in 1509, King's Surgeon under Henry II. Francis II. Charles IX. and Henry III. of France.

sion that induced Paræus to follow the French armies while yet very young; and we have a singular testimony of his early abilities, from an old physician, who, after the taking of the city of Turin, always called for young Paré "when any great surgical work was in hand, because he was delighted with the bold and spirited manner in which he performed all the great operations." To the seigneur le mareschal Montjan this old physician said at parting, "My lord, you have got a surgeon young in years, but old in experience and wisdom. Keep him carefully, for he will do you both service and honour." Paré himself tells this tale of his early days in the mere garrulity of old age; but along with this ebullition of vanity there is good sense and even modesty; for he adds soon after, "But the good old man did not know that I had lived three years in the Hotel Dieu attending the sick." Paré began his career in the Hotel Dieu. He performed there many operations upon the living, and learned much of anatomy from the dead body. He perfected himself by practising in the camps and armies; and having lived in familiar society with the king and nobles of France, he finished a long, honourable, and busy life, in the city of Paris. It is seen in the history of the French Academy, that the princes and generals of France willingly took the field when they could prevail upon Paré to go out along with them; and at the time when all the noblesse of the kingdom were shut up in Mentz, which was besieged by Charles V. in person, at the head of 100,000 men, they sent a sort of embassy to the king their master, beseeching him to send Paré to them. An Italian captain, for a great reward, introduced him into the city. They instantly sent at midnight to awaken the prince, who commanded the city, with the good news of his arrival. The governor begged of him that he would go next day and show himself upon the breach. He was received with shouts of triumph. Mentz was then the bulwark of France; and it has always been ascribed to the presence of this single man (so perfect was their confidence in him), that they kept the city till the gallant army which lay around it perished beneath its walls.

Above all, improve yourselves in anatomy. It was by their knowledge of anatomy that Paré, Dionis, Heister, Wiseman, Le Dran *, were distinguished among hundreds of other surgeons in the camp: this was, in their own opinions, the point from which their professional excellency and public character arose—a character founded not on the patronage of the great, nor on high appointments, but on severe previous study. And be it your comfort to know that they were just as you are. It was their own intense diligence, and, above all, their acquaintance with anatomy, the very basis of our science, which made them the first surgeons in the chief cities of Holland, England, and France, the best authors in their own day, and the highest authorities in ours.

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* *Dionis,* Reader of Anatomy and Surgery in the Royal Gardens at Paris under Louis XIV. in 1680. He wrote a System of Anatomy, and his *Cours d'Operations de Chirurgerie.*

Heister studied at Amsterdam under Ruysch and Boerhaave, was Professor of Anatomy and Surgery first at Altorf. He published a *Compendium Anatomicum* and Institutions of Surgery in 1718.

Wiseman, Serjeant-Surgeon to Charles II. having served in the civil wars. He wrote on tumors, ulcers, gunshot wounds, fractures, and luxations. His works are much esteemed.

Le Dran, a Parisian surgeon, born in 1685. He published on the Stone, Surgical Observations, the Operation of Surgery, and a Book of Consultations on Surgical Diseases.

Anatomy has always been acknowledged as the basis of all medical education. In those days, when surgery had not any respectable rank in general science, the physicians, who were anatomists, taught the surgeons. The surgeons were but their servants, assistants, and operators. When the surgeons began to learn anatomy, their part of the profession began to improve; for it was then only that anatomy and surgery, the theory and practice, were rightly combined. In the early days of surgery every book was regularly prefaced with a system of the anatomy of the human body; and if this preludium be omitted now, it is because anatomy is become, in itself, an important study. It is not by sketches and slight views that a surgeon can become truly accomplished in it. Every one is presumed to be thoroughly informed in that study which contains the elements of surgery and of all medical science. Anatomy, I repeat it, is indeed the basis of medical education, the only one which will be acknowledged by any sensible and well-informed man. Chemistry, physiology, pathology, all look back to the structure and functions of the human body, and twine themselves round this great trunk.

If a surgeon ignorant of the parts of the human body should be called to perform even an established and regular operation, which he has often seen performed, how must he tremble at the thoughts of what he has to do! Faltering and disconcerted—hesitating at every step! Acting only as he has seen others act, he is interrupted, startled, perplexed with every new occurrence. He has foreseen nothing, provided for no accident, and every accident alarms him. He moves fearfully and timorously onwards, like a blind man who walks with an air of confidence on an accustomed road, but when any new object presents itself, or the road is changed, is bewildered and lost.

We see untaught men operating upon their fellow-creatures in cases of life and death, in aneurism, lithotomy, hernia, trepan, without the slightest knowledge of the anatomy of the parts, much less any right ideas of their conditions, and new relations to each other in the state of disease. But such operators are seen agitated, miserable, trembling—hesitating in the midst of difficulties—turning round to their friends for that support which should come from within—feeling in the wound for things which they do not understand—holding consultations amid the cries of the patient—or even retiring to consult about his case, while he lies bleeding in great pain and awful expectation; and thus, while they are making ungenerous struggles to gain a false reputation, they are incurring reproaches which attend them through life. But a military surgeon cannot even do this. In the time of his greatest difficulties, he is unsupported and alone. He cannot, when performing trepan or amputation, turn to his servants to ask advice; and if, in dilating a wound or searching for a ball, he cut the femoral artery, or any of its great branches, you know what will happen. In his irregular unpremeditated operations life is saved or lost by one glance of his eye and one turn of his hand. He strikes the axillary artery, and his patient is safe—he loses it, and his patient expires!

But in this matter, Gentlemen, there can be no mistake. It is to those only who are skilled in anatomy that we ourselves would trust our health in case of disease, or our persons in any great operation. Even the ill-judging world decides exactly thus; for power, blindfold and undiscerning as it often is, may put unworthy men into places of trust and honour; but can it procure for them confidence, and the public esteem, or that character and lasting reputation which will always, I hope, be dearer to you than mere gain? By being so much exalted, they are but the more degraded—"Poor rich men!"

It is this knowledge of anatomy that has made the great surgeons of this and other countries respected in their own days, and remembered in ours. This consecrates their works, and marks them with the seal of sterling merit; by this their fame will be preserved in all times; and while we read their writings with unabating pleasure, may we not learn to follow them in the same honourable path, and, like them, pursue the true way to be great in our profession?

No sooner do you take up the works of any author, and read them with proper diligence, than you perceive, from the very forms of his books, the order and character of his studies. If he be a man unlearned in his profession, and have (as is but too much the custom) learned it by hearsay only, his tedious unmeaning books will be soon thrown aside,—they will indeed seldom fall into your hands. But if he be a perfect surgeon, like those whom I delight to set before you as examples, then you will find all his remarks arranged, explained, illustrated, and enforced with peculiar ardour. His perfect knowledge of the human body brings all his experience into the most useful forms; his histories are plain and important; he dwells with judgment upon those points which are peculiarly difficult, and resolves them, by continual reference, to the structure and functions of the parts. The most surprising cases become credible when he relates them; the most ordinary facts become instructive: we never read such an author without pleasure as well as instruction; at every turn, in every difficult question, we perceive his superior penetration, knowledge, decision, good conduct. But far otherwise is it when we read the books of some others, whose histories are merely surprising tales, to which the want of anatomical knowledge gives an air of idle romance.

Pathology, or the diseased states of the human body, must also be with you a principal study; for that will serve as the basis of well-founded confidence in yourselves, and of inexhaustible resources in occasions of difficulty or pressing danger. Do not let any man persuade you that theories are of no avail. The comparing of diseases and wounds with the natural form, sound constitution, and healthy actions of the part, forms a kind of theory which will not deceive you; and while you are studying such subjects, you are digging for the hidden gold which you will surely find, though not in the exact place or form in which you expected to find it.

General theories indeed are often but the works of idle men, of those who want industry or knowledge for searching into particulars, who are hurried away by an imagination too rapid, and too fervent to be useful, in a profession like ours; of men "who fill their books with toys, and lies, and vain conceits." But particular points should be studied by the young surgeon with unremitting diligence; and he who has a command of particular points, who has so combined anatomy and pathology, that he can revolve each case, and each accident of a case, in his mind, till it become quite plain and easy to him, will not fail to have a formed and habitual taste for great and general views, and an intelligence in all the great points of his profession, far excelling, in sound sense and sober usefulness, the wild unfounded conceits of professed theorists.

Anatomy and pathology are studies to which you will be easily persuaded to direct your attention; and you find indeed in every book some instruction on these points. But the very highest study of all, I mean the history of our science, is much neglected. I know that you are well prepared to receive ingenuously, in sincerity and kindness, whatever I have to say to you on these interesting subjects; and therefore I will mention to you, that it is too much the temper of our times to be satisfied with superficial and imperfect studies—with such scanty gleanings of knowledge as are to be gathered from mere school-books, and from the mouth of a teacher. Indeed, it is with us now as in those times when books were scarce, when printing was not yet invented, when a single physician presided over a whole country, and having acquired a reputation, perhaps by some extravagant fantastic doctrine, was enabled to gather round him a number of young men, and thus he formed a school, whose dogmas altered not—whose pupils were not allowed to range beyond that magic circle which their master had drawn round about them. I believe I do not judge too hardly when I say, that, by all appearance, there are many, in the present day, who are contented to learn the most arduous of all sciences "by hearsay and report!"—by talking about it—by walking the wards of hospitals, or lounging through the classes of a college—and by hearing and repeating the news of the passing day. This scanty and vulgar kind of knowledge is but ill calculated to inspire a man with the love of his profession, or make him really deserving of confidence and respect.

The truth is, that the practices and the prejudices of the old times mix themselves with the more orderly and perfect operations of the present day; and this is a subject of study which we must not neglect. We have now leisure to observe how slowly diseases have been understood, or operations invented or improved; we can remark how slowly and how imperfectly anatomy has been applied even to this day. At this moment we are employed in rooting out the prejudices and barbarous practices of those Gothic times; for the practice of the older surgeons was marked with all kinds of violence, an indifference about the simple cure of diseases, and a passion for operations,—as the cutting off of limbs, the searing of arteries, the sewing of bowels, the trepanning of sculls round and round, and all the excesses and horrors of surgery.

Is it not most unaccountable to see men among us expecting to excel in a profession which they have not studied? eager to be known as improvers, without having ripened their minds by studying the inventions of others? vain of their opinions, practices, and pathologies of diseases, in which they are often excelled and anticipated by authors which they have never read? Many a busy creature do we see proclaiming, as fine inventions of his own, instruments or operations which have been described, drawn, commented upon, condemned, neglected, and revived again, centuries before this new inventor of old things was himself born. While he troubles the world with his novelties, he has every fault but that of designing ill, or committing any wilful plagiarism; he is innocent of the knowledge of all old inventions. Whoever has thus neglected to study the history of our profession has a narrow mind, and prefers the little opinions of his particular master to the accumulated wisdom of ages; he dwells with enthusiasm upon those theories which have taken first possession of his mind, and never is he able to emerge from the atmosphere of the particular school in which he was bred.

Much has been said about the qualifications of a surgeon, as if nature had not endowed us all with abilities equal to the common and necessary duties of life. On this favourite theme, however, authors have descanted to little purpose; for those qualities which are most loudly praised are such as cannot be acquired, and have little relation to the abilities, dexterity, or knowledge of a surgeon. The elegant description of Celsus is not judicious, although it suits the times in which he wrote; when surgeons were the servants of physicians, who required of them chiefly a quick eye and a steady hand, and that unfeeling hardihood, which is so well described by the "manu strenua, stabili, nec unquam intremiscente; animo intrepidus, immisericors." By such descriptions surgeons are disgraced not praised; and the modern surgeons, in repeating this description, have but caricatured the classic picture of Celsus. The bonam formam, oculos claros, manus firmas, digitos graciles of those Gothic successors of Celsus, are rather directions for choosing a nurse or paramour; yet many an awkward fool, when he was writing such silly things, thought he was describing "his own fine parts and pretty person."

I would have you to dwell with confidence on this, that all that is essential to the character of a good surgeon may be acquired. To think otherwise were as discouraging as untrue. The eye is in the mind. A learned eye is a discerning and a quick one. And his hand will not easily tremble who knows perfectly what the hand should do—what the hand may do. Study well the essentials of your profession, learn your duties, and trust the rest to nature. For, be assured that dexterity and boldness follow judgment and skill as closely as the shadow does the substance. Though the qualifications of a surgeon are not to be acquired, yet assuredly they may be improved; and he will be disappointed who waits for a sort of inspiration, and expects to find in himself, naturally and without practice, a quick resolution, a judicious eye, or a dexterous hand. He may believe himself dexterous without knowledge, but it will be mere whiffling agility, and charlatan trick, in place of masterly and deliberate boldness.

But boldness is a seducing word, and the passion of acquiring character in operations is surely full of danger; it is fit for those only to profess who have no higher claim to the public esteem. We are but too apt to allow the "audax in periculis" to be the character of a good surgeon. But this is a temper of mind and a line of conduct which can benefit nothing but the character of the surgeon himself; for as to his patient, this shameless thirst of fame, this unprincipled ambition, is full of danger. I would say rather with Guy de Chauliac,—Sit audax in securis, timidus in periculis; let him cut rapidly and dexterously where all is safe, slowly and cautiously where there is danger. He should not, where quickness can do no harm, torture his patient and protract his pain with foolish and conceited tricks;—such affectation of dexterity is but a pitiful ambition in those who use it. Nor should he, in any doubtful case, endanger his patient, merely to gratify the fools who estimate his dexterity by no other criterion than the stop-watch. The patient commits himself into the hands of his surgeon, constitutes him judge in all difficulties; and would willingly endure a more severe and lingering operation, if there appeared circumstances of peculiar danger. Should not then the present suffering of the patient, the sense of his own duty, and, above all, the trust that is reposed in him, occupy the surgeon's mind too much to leave room for vain or selfish thoughts? Yet we every day see surgeons cutting out harmless tumours with affected and cruel deliberation, and in the same hour plunging a gorget among the viscera with unrelenting rashness.

When a man enters upon such duties as these, he should be diligent, watchful, and laborious; humane, friendly, and self-denying; full of unceasing anxiety for others, and a noble disregard of himself. We will not define the chief qualities of a surgeon in this cold-hearted way,—of personal and showy accomplishments; mercy and tenderness towards his patients, and every kind of charity, are the chief virtues and most becoming ornaments of a surgeon. He must not be wearied out by the tediousness of his patient's sickness, nor provoked by the irritation of ill-judging and officious friends. He must not show himself respectful and attentive to the rich only, nor careless of the poor, because they are so. If sometimes an operation be required, let it be done rapidly where there is no danger; but where there is any thing doubtful, let it be done slowly. If there be a tedious lingering disease, the surgeon must be every thing to his patient; watchful, friendly, compassionate, cheerful—for the patient lives upon his good looks; it is when his surgeon becomes careless, or seems to forsake him, that he falls into despair.

These are among the chief duties of every surgeon—his daily occupations. But the duties of a military surgeon are such, in the time of battle, that it is difficult to imagine how he has fortitude for such a scene. While others have things to do, daring and spirited, suited to the time, all his works require deliberation, judgment, and perfect composure; he alone sits at a distance from the work of war, and all the hideous sights have their full effect upon his mind. And yet there are things still worse to bear than the natural, inevitable horrors and hardships of service,—slights, losses, disappointments, and unmerited neglect; by those, too, whom the surgeon has served, and who should be the natural guardians of his interests.

DISCOURSE II.

HISTORY OF THE DOCTRINE OF ADHESION.

To pass at once from study to practice, from the mere reading of books to the most dangerous operations upon the living body, is an alarming step; it fills us with anxiety to think of it; and very seriously should we reflect upon the course of our studies; where one wrong step leads us into labyrinths of difficulties, and our time, our strength, and our patience, may be wasted in an unavailing struggle; even our love for our profession may yield to obstacles which are unexpected and unnatural.

Of all these difficulties I know of none so discouraging to the eager spirit of a young man as the too early attempt to procure a knowledge of practice. To be accomplished for practice is to have a mind stored with all kinds of knowledge; and a young man should gradually rise through all the dependencies of study, should pass through the history of his profession, before he can be capable of understanding those conclusions which we call rules of practice. He must know whence those rules have arisen, why they have been changed, how they have been improved. He should know the period at which each interesting practice began, in what countries it has prevailed, and by what authors, and by what kind of reasoning, each rule in our general code is supported. For each rule is to be received with limitations and exceptions, with a degree of diffidence or confidence proportioned to the authorities and proofs which it brings along with it. To deliver rules, unqualified and absolute rules, into the hands of an untaught man, were to put a two-edged sword into the hands of an idiot.

Who is there so humble as to be willing to practise an art which he does not understand, or to move according to rules which he cannot explain? rules which are not the result of his own particular knowledge, but the dogmas of others, the opinions of schools and writers whose works perhaps he knows not! of whose doctrines he is ignorant! whose practices he is to follow with a mean and slavish deference!

Rules of practice form the sum total of our knowledge, but they are not the means by which knowledge is to be acquired. They enter slowly into young minds, and have but a slender hold on an imagination unheated, unoccupied with the subject, unconscious of the slow and gradual changes, the silent but important revolutions, by which science has been improved. The rules which I shall require you to learn shall be founded on histories, theories, and facts. You shall not follow with servility the practice of myself or of any master; your opinions shall be your own, the result of your own particular knowledge. I know both how to respect the difficulties and uncertainties which you must feel when first entering on study, and how to lead you onwards to a general knowledge of your profession by slow and gradual steps; and as for the absolute rules of practice, I will not play the pedant over you, but give you a due share in forming them for yourselves.

You may depend upon it, that wherever there is a difference betwixt ancient and modern surgery, there is also a connexion of infinite use to us if we could find it out; and it is by studying these connexions that we are enabled to give a good account, not merely of the useless antiquities of surgery, but of the excellencies of modern practice. I have also observed, that where there exist any very singular prejudices connected with our profession, they have first arisen among the profession, though now perhaps they are to be found only among the vulgar; and when there have been ill reports among the vulgar concerning the practices of medical men, they are seldom entirely void of truth.

In the treatment of wounds, surgeons were at one time really very rude and cruel; they absolutely delayed the cure. They never allowed the lips of a wound to fall together: they filled it with dressings and acrid balsams, or distended it with tents and leaden tubes. They were ingenious in every invention to prevent its sudden healing. "The chief method of healing wounds, and the most respected," says Fiorovanti, "is that called Canonico, in which there be four operations: the first is digestion; the second is mundification; the third is incarnation; and the fourth is cicatrization." Every wound was forced into a painful suppuration, which the surgeons of those days were careful to encourage in proportion as the wound seemed more inflamed. The quantity of matter was again an argument that the wound needed to be thoroughly purged of its foul humours. The pain of a wound and the waste of substance was very great, under their management: the cure was proportionably slow, the scar was broad and unsightly; but they comforted themselves by saying, that this method alone was sure, and consistent with the rules of art. Those few surgeons who ventured upon the cure by direct and immediate adhesion, went fearfully and timidly to work. They were in continual apprehension of ill accidents; and having failed to comply with the canonical or regular method, having neglected to purge the wound, the patient never suffered the slightest alteration of his health, even at the distance of years, which was not imputed, either from malice or ignorance, to this sudden and improvident cure. This was the real origin of the secret dressings; and nothing can be more singular than the various inventions which surgeons, in those days, fell upon, to persuade their patients to let their wounds be easily healed, and, at the same time, protect themselves from blame. Indeed, when we consider the continual protestations made by La Motte and other good surgeons of their never having, for the sake of gain, used any tents or injections to protract a cure, we cannot banish from our minds some very unpleasant reflections. For while these authors enter their protest against the general conduct of other surgeons, and show their anxiety to proclaim their own innocence, we cannot but see that they point at some practices and motives of conduct which we fain would not believe. In those days, every flap of skin, instead of being reunited, was cut away; every open wound was dressed as a sore, and every deep one was plugged up with a tent, lest it should heal. Tents, syndons, setons, leaden canulas, and strong injections, were among the chief violences of ancient surgery. And no man wishing to treat his patient *more canonico*, or by that rule which alone could vindicate him to the profession, no man, I say, who regarded his own character, went without this cruel apparatus of tents and syndons when he was to dress even a slight wound. The old surgeons never put the lips of any wound together: if it was not large and free, their rule was to dilate it, but never with the knife; with a sort of forceps they tore it open; they seldom made counter openings to let out the matter; they never sought to put an end to the formation of pus, and the waste of the fleshy parts, but encouraged the suppurations. They plugged up the orifice, in order to dilate it. They made their tents long, that they might convey acrid medicines to the very bottom of the wound. They forced the suppuration, in order to prepare it for the second stage of their process, viz. incarnation. They prevented the natural and easy flow of the matter, that they might have the satisfaction of seeing it spout out in great profusion when they withdrew their tent. They opposed their own ways to those of nature, and liked nothing which was not done by main force of surgery. This is what I mean when I speak of their coarse and cruel practice; tents, syndons, setons, leaden canulas, may all be used with advantage; but I am now observing only how they were abused; for no wound escaped this violence; and the practice of an ancient surgeon was exactly the same with that by which beggars counterfeit sores, or rather convert accidental wounds into perpetual ulcers. The most simple wounds of the limbs were frequently tortured by the old surgeons into the form of malignant sores, running for many months; wounds of the great cavities were always distended with tents to the imminent danger of the patient: if he survived, there remained fistulas which would never heal; the sores ran more or less according to his state of health, or the season of the year; and a man wounded in the chest wore his leaden canula for life. "But that which surprises me most of all," says an old author, "is to find the afflicted persons brook the inconveniences they suffer with a sort of satisfaction."

The old surgeons thrust their tents into all wounds, both those which were in danger of healing and those also which could not heal. They thrust them into gun-shot wounds, of which, if they had understood the nature, they could have been under no apprehension of their healing suddenly, since the whole course of a gun-shot wound is mortified, and the parts through which the ball has passed being effectually killed, must be thrown off in sloughs. They thrust their long tents into the neck, or even into wounds of the cheek, till the neck or head swelled monstrously. Even in compound fractures, they thrust them deep betwixt the ends of the broken bones, as if they had been afraid lest a callus should form. They introduced their tents even into the cavities of the belly and breast. They never trepanned the scull where there was inward suppuration, without thrusting a tent into the substance of the brain itself, though sometimes they were contented with laying in a syndon, or slip of linen*. "Often I am sure," says La Motte, "I have seen those who would have been very willing to have taken the help of a mallet to drive in their tents into the thorax. It was from shame only that they refrained." "In my young days," says Belloste, "when I frequented hospitals, and practised with very able surgeons, I have seen, at the time of the dressing, the tents for the most part expelled from the wounds in spite of the bolster and bandage."

Belloste was the first reformer who arose in France, and I refer you to his book for some very extraordinary facts. In one soldier, who was wounded quite across the belly by a ball, which entered near the navel, and passed out through the kidney, he found that the wound inflicted by the ball at entering had healed in spite of all the surgeon's diligence; but the posterior orifice where the kidney was injured, the surgeon had contrived to keep open with a very long and hard tent, which he had thrust even into the substance of the kidney, occasioning a perpetual flow of urine from the part. This fistula Belloste cured by drawing out the tent, eating away the callous edges of the sore with caustic, pressing its lips together, and injecting occasionally some vulnerary water.

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* Vesalius, Chirurgia Mag. p. 1002.

Even the joints were not spared. In the same war, Mr. Belloste attended an officer who had been wounded in the knee, and had been dressed by his own surgeon, skilfully enough, according to the fashion of those times. But, fortunately, at the end of four months, his own surgeon was obliged to go away; and Mr. Belloste was called in, and found in the knee six fistulous holes, each hole spiked up with a hard tent, and each tent long enough to reach to the bottom of the joint. The leg and foot were exceedingly swelled, and the body proportionably emaciated. The patient had a hectic fever, perpetual watchfulness, insufferable pain, and a loathing of all kinds of food. The whole joint was surrounded with matter, the gutter leading backwards from each fistulous sore communicated with some adjoining hole, and the dressers had every morning stopped up the rest of the openings with their fingers, while they injected, by some one hole, a spirituous tincture, which distended the whole knee with intolerable pain. The first night of sound sleep which the patient had enjoyed from the day of his wound was that in which Mr. Belloste dressed him in an easy way; and such was the impression this relief made upon him, that in the morning, amidst all his friends, he embraced Mr. Belloste as one who had saved his life; and indeed he was entirely recovered in a month.

Among those who wrote against this rude and violent practice, I might number all the oldest and most respectable surgeons. But although Paré says, "God knows the pleasure and profit too I have enjoyed from using tents more sparingly*," no one was bold enough openly to declare his intention of joining the lips of a wound by direct adhesion. A man proposing such romantic doctrines, directly and openly, would have been held in high contempt by the learned; but if he was bold and cunning enough to give an air of incantation to his cures, or to declare that they were performed by a secret philosophical sympathy known to himself only, or to other very learned men, then he was sure of rousing at least one half of the learned world to combat in his cause. We find indeed no one sympathetic cure which is not performed plainly by procuring a speedy agglutination of the wound; nor one surgeon in Europe who ventured to unite wounds directly by adhesion, without pretending to have learnt from some eastern sage, or to have found out by deep studies in philosophy and alchemy, a sympathetic, or, as they often called it, a philosophical cure of wounds†.

These were the cures known by the name of Sympathetic, because performed at a distance, and by the medium of a bloody towel, or by practising upon the bloody stain which was left upon the sword or knife. In want of the guilty knife, they drew any other knife or sword across the wound, and stained it with blood, and operated upon it. The medicines which they used they called sympathetic powders, sympathetic solutions, or the unguentum armarium, because the ointment was applied to the weapon.

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* Page 209.

† My brother, in the former edition, at this place enters into a subject of more curiosity than utility to the student: the history of the Sympathetic Powder.

At first we are surprised with the universal approbation which these follies met with from all the great men of those times. They all acknowledge that sympathetic cures were successful. They refused to practise these cures, only because they were impious and unlawful; for even Hildanus and Purmannus say, "though many have written against this, how can we contradict matters of fact." The matter of fact is easily explained. These sympathetic physicians understood the cure of wounds by adhesion more perfectly than the other physicians of their time. The world needed to be cheated into this safe and easy method of cure. They used their sympathetic cure (which was plainly a way of procuring adhesion) in no cases which might bring disgrace upon their art; they refused to use it in wounds where they could foresee suppuration; they declined it "where much digestion was required, or where the larger blood vessels were wounded." They absolutely refused to perform their sympathetics in cases of gun-shot wounds*. They took care to pledge themselves only for those wounds which they were sure might be made to adhere. Purmannus himself saw a quack in the city of Glogau mount the stage, and in presence of the people make thirteen gashes in the fleshy part of his own arm, and roll it up very tight, closing first the wounds with slips of linen dipped in some warm mixture. According to his promise, he produced it next day to the people as good as healed. "This proves," says Purmannus, "that this man knew how to cure wounds in a day's time, without the tedious method of bringing them to suppuration. A young surgeon who lived in my house bought this secret from him for six rix dollars; it was merely a plaster made of gum and mucilage; so that this may be truly called gluing wounds together*."

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* Senertus, in his Liber Practica, 5 p. 4. c. 10, observes, especially in speaking of the unguentum armarium, that even among those who had praised it the most, no one ever ventured to use it in gun-shot wounds, though he himself could produce some very singular incontestable proofs of its success.

In those days, then, the curing of a wound by adhesion was a thing which gave reputation even to a mountebank, and seemed indeed miraculous. But the sympathetic doctors knew the secret, and how to make their own use of it. They chose out fit cases of clean incised wounds, they put the lips neatly together, and very generally held them close by a sticking plaster, so well composed and so firm, that they called it the Emplastrum Strictivum†, they took care never to undo the dressing till the wound was healed. Had they openly professed to heal a wound of the scalp without exfoliating the bone, or a wound of the flesh without a due purging off of the foul humours, had they proposed to lay the lips of a wound simply together and make them adhere, they would have been greatly abused for following the simple rules of nature. But they contrived to get credit for something like witchcraft, and they condescended to dress the axes and swords that the wounds themselves might have leave to lie at rest till they healed. I will add to these a short history of one of our own physicians, above the rank, but not above the practices, of a quack. It will prove how very slowly the best methods were received, and how perfectly this practice of procuring immediate adhesion had succeeded, even in the most dangerous wounds and in the rudest hands.

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* When carpenters wound themselves with their tools, they take a thin wood shaving, and spreading it with hot glue, they glue together the lips of the wound; the shaving sticks fast till the wound adheres, and soon falls off of its own accord.

† These very powerful adhesive plasters were very generally composed of gums, wax, strong glue, and sometimes white of eggs, and the composition, something betwixt a paste and a plaster, was made so firm that nothing could displace it till the wound adhered.

It is to be noticed, that in all the methods of secret dressing, there has been a strange mixture of quackery and incantation; and whether the cure was performed by sympathetic powders, or unguentum armarium, or by sucking, the reports of its success were always very extravagant; the reports and cases of Dr. Colbatch are by no means over modest. His cases are very extravagant in the manner and circumstances, but in all the essentials, I believe, they are very true. We are to judge from his general principles, not from his particular facts; or, in other words, we must make large allowance for the manners of those times. We dare not, for example, trust entirely to his reports concerning the army surgeons, for it was his business to find out reproaches against them; but there are many things which show him to have been a man of observation, one who understood the radical errors of their practice. "I observe," says he, first, "That in all wounds of any consequence, though merely flesh wounds, &c. they confine their patients to the lowest diet imaginable, forbidding them flesh and wine, and that although they have suffered great loss of blood." Secondly, he says, "I will not mention the tenting, probing, and other trumpery and nonsense which are used by most surgeons to the great detriment of their patients." His method, so far as he allows himself to disclose it, is manifestly one which must have been of infinite importance in an army, where all the surgeons tortured their patients *more canonico*, and where he alone cured wounds by adhesion. He explains himself thus: "Suppose a wound to be made with a sword, or other cutting instrument, the length or depth of which signifies nothing, I dissolve some quantity of my powder in water, I wash and squeeze the wound, and inject a little of this said water into it; I then close its edges together, and, if wide and large, I stitch it up. In all cases where my medicines have been applied in good time, especially in all incised wounds, the wounds are perfectly cured in a few days without being brought to suppuration, and I have frequently observed, that at about four days' end, such wounds have been filled with a substance like unto hartshorn gelly, which I have conjectured to be the new flesh." When we see the man proceeding on such certain principles, we are sure that he must have been of infinite use; and being the only man in the camp who knew how to cure a wound by adhesion, his cures must have been very surprising, and his patients particularly easy, while those of others were enduring great pain. To be assured of this, we need only know his principle, and we must not undervalue his skill on account of the lying exaggerations with which he thinks fit to set it off. I am persuaded that he often cured, without any bad symptom, men who were thrust through the breast or belly, and yet I am amused with his manner of telling it. In wounds of the breast he never fails to settle the point of the lungs being actually wounded, by telling us how great the blast of air was. In most of his cases, "the blast is almost equal to that of an ordinary pair of bellows." In one case it blew a perfect hurricane; for Mr. Cholmondely, his assistant, declared that he could scarcely with his hand keep on a dressing: so that in order to bring the lips of the wound together, he took a needle and thread, and sewed up the wound; but the force of the air was so great, that he was forced to make his stitches in the external part of the bone (i. e. of the rib), which is gristly, "by reason that the skin was not strong enough to hold them."

Another of those who followed our armies two centuries ago is that famous physician and knight Fiorovanti. He protests much against the irregular method of digesting and incarning of wounds, the stuffing them, teasing them with all kinds of washes and ointments, and parching them with turpentines and hot oils. "Dress your wounds," says Fiorovanti, "in whatever parts of the body, without any tenting at all; for the third order of cure is of our own invention, that is, wheresoever a man hath a wound, either simple or compound, the first thing that is to be done therein is to join the parts close together, and to stitch them and dress them with various sorts of drying medicines. As to simple wounds, where no sinew, bone, or vein, is injured, join the wound together quickly, and stitch it close, as they use to sew bags, and not with great wide stitches*. To heal wounds according to the manner of the ancients, it were great trouble to the chirurgeon, and pity to see the pain of the patient." Now, since this Fiorovanti was at such pains in putting the lips of the wound together, we need not wonder that his balsam, Balsamum Fiorovanti, had come into such repute, nor need we trouble ourselves to inquire what it was. Still this most excellent practice of procuring adhesion was avowed by no one; and while the regular surgical method of suppurating and digesting, and incarning and cicatrizing of wounds, was alone acknowledged by men of learning, this better practice of procuring adhesion continued almost exclusively in the hands of quacks.

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* Let the reader remember that this is given historically, not as an example.

Though all these cures by adhesion were very mysteriously performed, yet one in particular was called the secret dressing, in which great pains were taken, before laying the lips of the wound together, to suck out all the blood. The cure of wounds by sucking was called the secret dressing: it was chiefly used in the army; the drummers of the regiment were the suckers; and the common soldiers submitted to this cure secretly, in order to conceal their quarrels from their officers and from the priests. The practice of duelling had proceeded to such lengths in France, that even the common soldiers settled their drunken quarrels with the sword. A hasty word betwixt soldiers of two regiments in garrison established a perpetual quarrel betwixt the corps. They went out in the evening to the skirts of some adjoining wood, and fought by scores; when they happened to quarrel in taverns, they fixed their pocket-knives upon the brooms and mop-sticks; and when their knives and side-arms were taken from them, they fought with sticks sharpened and hardened in the fire, which we find made more desperate wounds than tempered swords; wounds, bruised, livid, and sloughing, like those made by shot. When a party went out to the wood, the drummer of the regiment, or some good experienced sucker, went along with them. The duel ended the moment that one of the combatants received a wound; the sucker immediately applied himself to suck the wound, and continued sucking and discharging the blood till the wound ceased to bleed, and then, the wound being clean, he applied a piece of chewed paper upon the mouth of it, tied up the limb with a tight bandage, and the patient walked home. The savoir-faire, or trick and cunning of this way of cure, consisted in making grimaces and contortions, signing their patient with the sign of the cross, and muttering between their teeth some unintelligible jargon. All their care was to keep their profession among themselves; and it was from this profanation of the name of Christ, and this abuse of the sign of his cross, that there arose a hot war betwixt the priests and the suckers: the priests refusing confession, extreme unction, or any sacrament of the church, to those who had undergone these magical or diabolical ceremonies; while the suckers, on the other hand, refused to suck those who had any connexion with the priests. The former were afraid of losing the dues of the church, and the privilege of giving extreme unction, and dismissing the soul to heaven (for those who submitted to the secret dressing were usually past all relief before the secret was disclosed to the priests): the latter, on their parts, were careful to preserve a trade which was not without its emoluments. Verduc observes, "Suxerunt quidem, at non sanguinem sed potius aurum," They were still more skilful in sucking gold than blood.

In flesh wounds they could not fail of perfect success. The sucking out the blood, the cleaning the wound, the laying on of compresses, and the close and nice bandages which they applied, prevented the further effusion of blood (which always acts as a foreign body, and prevents adhesion), and secured to them a very speedy cure. No wonder, then, that this became a universal practice, and that men of high rank carried suckers with them when they went to fight duels. The success of the secret dressing was acknowledged by the most eminent surgeons. "I could well believe," says La Motte, speaking of the suckers, "that they often healed flesh wounds, of the arm, for example; but that they should heal wounds across the cavities of the breast and belly in a few days, and altogether conceal the wound, seemed quite incredible." Yet this was true, and this fact may be a comfortable assurance to us, that even among the viscera we may procure adhesion of the various wounded parts. For La Motte himself was incredulous; he had the faithful testimony of those secret combatants; he had often seen the scars, both on the back and on the breast, of wounds which must have passed quite through the bowels and lungs! but still he would not believe, until at last he had the good fortune to see this magical piece of surgery performed with perfect success.

"One day he was called to a young fellow, a common soldier, who had been run through the breast with a fair lounge, in at the pap and out at the shoulder. After having examined the wound, and noticed, says La Motte, the length of his antagonist's sword, being well satisfied that the weapon had pierced the lungs, and gone quite across the breast; I saw the drummer of the regiment (who was the sucker on this occasion) do his business. He first sucked one wound, then turning his patient over, he sucked next the opposite wound; he then applied a piece of chewed paper upon each, and next day the soldier was seen walking in the streets." After this, La Motte saw a man of better condition sucked with the same success. He was the brigadier of a horse regiment, who had been wounded quite across the lungs, but without any material harm to the lungs or great vessels. Thus, says La Motte, is this way of sucking wonderfully successful; and with great ingenuousness he adds, "Indeed it appears to me, that if these suckers applied their cure with ordinary discretion, sucking no wounds but such as could be cured by adhesion, their method would be more successful than any that we surgeons use*."

In duels with the sword, the wound is often in the thorax, and usually through the lungs; it is never a simple wound, and yet it will often heal; sometimes some great artery is wounded; the intercostal artery, perhaps, is touched, and pours out blood, the chest is filled with the blood, and the patient falls into oppressions and anxieties. Even in this complicated case, the suckers sometimes succeeded so far as to heal the outward wound; but the patient being oppressed by the inward bleeding, was in a few days in danger of suffocation, and often became unable to speak, had fallen into deadly faints, and was receiving the last sacrament of extreme unction before a regular surgeon was called to lay open the wound, and discharge the blood. Dionis had been troubled in his time with the suckers; and in a quarrel which happened in one of the courts of the palace of Versailles, two gentlemen of high rank were both at once wounded in the breast; one was sucked by the drummer of his own regiment, the other was committed to the care of Dionis; and next morning it was wickedly reported to the king, that the gentleman committed to the care of Dionis was dead, while he who was sucked was out of danger. This might have happened, and might have done harm a thousand ways! but so it chanced that the truth was directly the contrary to this first report; for, in the evening, this latter gentleman was seized with such oppression, that he had taken the last sacrament before Dionis could be brought to him. When he came, he performed the operation for empyema, opened the chest, let out the extravasated blood which oppressed him, so as to relieve him instantly, and cure him in a very short while. Both the patients were thus saved by Dionis.

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* La Motte, p. 22.

It seems as if from the first a sort of fatality had hung over the doctrine of adhesion, which was, however, in the end, destined to improve surgery more than any other. This practice had never been received by men of learning, nor risen into the importance of a doctrine; but it was about to do so, when, most unhappily for our profession, Talicotius published it as an invention of his own! but in a form so fantastic, and connected with such idle and trivial objects, that it became with all the learned, as well as among medical men, a matter of amusement; and the world was justified in their contempt and ridicule of it by the opinions of the greatest men in our science. "Neither art nor nature," says Vesalius, "is endowed with such powers as to restore a nose which has been cut off; to attempt such a cure is little better than if an ape should begin to philosophize, and say, I will go and learn to fly*." This was unfortunately the light in which all sensible men considered a doctrine which, had it been received a hundred years ago as it is at this day, would have saved the lives of thousands. But most unhappily, after the days of witchcraft and sympathetic cures were over, there rose up several doctrines too similar to them to be well received; the extravagance of the discoverers took away all hopes of profiting by their inventions; surgeons turned with contempt from the first dawnings of rational theory and sound practice, to their old canon of digesting, incarning, and cicatrizing wounds.

There is no question that the aqueous humour of the eye may be evacuated and restored again; that the blood may be transfused from body to body, not only with safety but with advantage, especially in hæmorrhagy; and that parts separated will reunite,—as an extracted tooth; which will, if put back presently into its socket, reunite with it, and continue a living part of the living body. If a tooth pulled out of the head, laid in a basin, washed in tepid water, and then put again into its own socket, or transferred to another person's jaw, can reunite, there need be no question that an incision being made in a man's arm, and his nostril pared, the flap of skin in the arm may be united to the nose; yet these facts, so nearly allied to the miraculous, in order to be well received, should have been prepared in a very modest way. But it was not so with these discoveries: Burhius and Kerkringius pretended to be possessed of particular medicines, by which they could restore the eye after it had been burst or cut open. Taylor, Woolhouse, and others, pretended to cure the blindness of old age, by extracting the muddy humours of the eye, and replacing them with fresh transparent humours, by which the sight became as clear and fine as in the youngest person. Many pretended to restore to the aged health and strength, by withdrawing from their system the effete blood, and filling them up with healthy and youthful blood. Purmannus drew off the blood of a merchant's son at Berlin, who had the leprosy, and infused into him the blood of a YOUNG LAMB, and cured him, to the admiration of many persons*. So much did the rage for these experiments prevail, of transfusing blood and injecting liquors into the veins, that Purmannus, after mentioning his having cured the falling sickness in several, by injecting medicines through the veins, concludes with saying, "It was also twice tried upon myself; first, when I was grievously afflicted with a sort of leprosy, but then it was not artificially performed; and again, a second time at Anslam, when I was sick of a violent fever, and ordered aqua cardui benedicti to be injected, upon which I was wholly delivered from my fever in less than two days' time."

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* "Atque proinde ejusmodi curationem tentare idem est ac si simia philosopharetur velletque per aërem volare." Vesalius, 983. Is it not very extraordinary that this very author Vesalius should be quoted by Portal, in his History of Surgery and Anatomy, as a strong supporter of Taliacotius's doctrines?

Taliacotius, a citizen of Bologna, was a man of great learning and skill; he lectured on anatomy and surgery in that city, and was buried in the church of St.

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* Purmannus, p. 304.

John's, where the Faculty of Medicine erected a statue in honour of him*.

Taliacotius begins with observing how trees receive a graft, and unite with it so entirely as to transmit a new flavour to the fruit. He recapitulates all the arts of ingrafting; and upon the analogy of these rules and practices he founds his theory of uniting the parts of the human body. He proposes to restore ears, noses, and lips that have been cut off. He pares the defective nostril, so as to make it raw, like the edge of a hare-lip; he cuts deep into the arm, and turns back a flap of the skin, but leaves the piece of skin still attached to the arm, so that it continues in full circulation; he pins it or sews it to the wing of the nose; ties the head to the arm by one bandage, so that it cannot move; and supports the head upon the neck by another bandage, so as to lessen the fatigue of the posture, and after ten or twelve days undoes the bandages, and cuts the flap away from the arm. If another nostril is wanting, he now makes the adventitious piece of skin raw, and joins it to the second nostril; and when all this is done, he carves out nostrils, and shapes the whole into the right form of a nose. He affirms that he had done this often; and that not unfrequently the hair grew upon such noses, so that they needed to be shaved. That all this is possible, I do most certainly believe; it actually was performed often; and at this day in India, where cutting off lips and noses is a common piece of revenge, and even a common punishment, an operation equally difficult is performed, when a piece of skin is cut up from the forehead, and turned down, to supply the place of the nose. Hildanus is one of unimpeached authority, who saw this operation of Taliacotius performed. Fienus is another, whose book is that of a scholar and a gentleman, who assures us of the truth of his success; and he also remarks that his statue was erected by the University of Bologna, after having witnessed many facts of this kind*.

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* D. O. M.

Gaspari Taliacotio civi Bononiensi philosopho ac medico ætatis nostræ celeberrimo. Cum universam humani corporis anatomen doctissimorum virorum frequentissimo conventu publice administratum facundia methodo ac doctrina admirabile explicavit, ejusque incompertas adhuc partes in lucem prodidit, animi grati et perpetuæ.

As there is nothing unnatural in this operation, as this reunion of divided parts is just such as we procure in more difficult circumstances every day, the doctrine, and all the useful conclusions which would have flowed from it, would not have fallen into such discredit, had it not been for the ignorance of some, who thought to lie the theory into credit, and who undertook to back up this reasonable doctrine of Taliacotius with absurd incredible stories. So much less dangerous is it to have a wise enemy than a foolish friend. The learned credulity of Van Swieten is not more particular than the vulgar credulity of Garengeot. This Garengeot had the boldness to stand out amongst the foremost of the defenders of Taliacotius, and risked the following tale:—"A young fellow," says he, "a soldier, reeling out of a tavern drunk, along with some of his companions, got into a quarrel, in which one of them bit his nose off, threw it into the gutter, and trode it under foot. He picked up his nose, flung it into Mr. Gallin's, an apothecary's shop, ran after the fellow who had done it, and when he returned, Mr. Gallin washed the nose at the well, stuck it with plaster in its place, and in two days after it was firmly united, and Mr. Garengeot, four days after, dressed the nose with his own hands." But this tale, after all, is but a poor one, compared with that told in the following terms, by sir Leonard Fioravanti, knight:—"Of the cure of one that had his nose cut off, and set on again.

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* In the hall of the Medical Faculty at Padua is a statue holding a nose in the hand, with the respectful epitaph which I have just recited engraven upon the pedestal. This was erected by his contemporaries, and could not be meant as a sarcasm; or if so, it was a very serious and expensive joke. 6. B. Cortesius, Mollinetus, and also Reaumur, in the French Academy of Sciences, declare the successes of Taliacotius; and Fienus, p. 168, says very directly in these terms: "Ego etiam testari possum Gaspar. Taliacotium professorem chirurgiæ in Acad. Bononiensi, plurimos hac arte nasos restituisse, quorum *ego aliquot restauratos in aliquibus vidi, alios actu fabricari*." "I have both seen finished noses of Taliacotius's, and have also seen him actually busied in making them."

"In that time, when I was in Africa, there happened something strange, and this was it. A certain gentleman, a Spaniard, that was called Seignior Andreas Guitiero, of the age of twenty-nine years, upon a time, walked in a field with a soldier, and fell at words with him, and began to draw. The soldier seeing that, struck him with the left hand and cut off his nose, and there it fell down in the sand, and then I happened to stand by and took it up, and pissed thereon to wash away the sand, and stitched it on again very close, and dressed it with our balsamum artificiato, and bound it up, and so let it remain eight days, thinking that it would have come to matter: nevertheless, when I did unbind it, I found it fast conglutinated, and then I only dressed it once more, and he was perfectly whole, so that all Naples did marvel hereat, as is well known, for the said Andreas doth live yet, and can testify the same*." The Taliacotian doctrine of adhesion is unquestionably true, but not to this extent. I hold it possible to preserve every flap of skin, though almost entirely insulated, though left hanging by a tag merely; but those parts which are entirely separated are entirely and irrecoverably dead. I agree with Dionis that these pretensions are absurd, but we may easily sew up noses, and lips, and cheeks, which are only in part cut away*; and yet I know of some men of the first rank in their profession who believe this tale of Garengeot's. One gentleman of very particular abilities carried me to see a man who had chopped off the point of his finger with a tobacco-knife; it dropped down upon the board before him, he took up the piece of his finger, clapped it in its place, fixed it with a roller, and there it sticks to this day. I am, I confess, very sceptical with regard, not to the veracity of my friend, but to the explanation of the fact; may not so small a piece of the finger have rotted after it was bandaged, the remaining flesh upon the point of the finger growing up to supply its place? But if this be really true, if we can fix on a finger, or a piece of a finger, which has been chopped off, then we have such a suite of facts, that we may in future expect much more extraordinary cures; Mr. Gallin fixed on a nose that had been trodden under foot! Fioravanti pissed on another nose, and

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* M. De la Faye, one of the greatest surgeons of France, was at the pains to try this experiment in various ways. He cut off parts of the flesh and skin in dogs, and fastened them on again as nicely as he could, but to no purpose; and says M. De la Faye,

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even while I was making these experiments, a certain person having cut himself betwixt the thumb and forefinger, I came in good time to find the piece of flesh, about the bulk of a shilling, which had fallen on the ground disregarded. I applied it as well as possible to see whether it would reunite; it fell off in scales, leaving such a cicatrix as convinced me of the inutility of all such attempts. La Faye's Principes de Chirurg. p. 370.

* Vide Dionis, p. 64. where he denies absolutely and unconditionally Taliacotius's art of making ears and noses out of the flesh of the arm.

then stuck it on! and somebody, I know not who, put on a finger! and who knows but we may some day or other need to set on a leg or a head? That no person, in case of any sudden accident, may plead ignorance, I shall here describe the method from the celebrated Rabelais of setting on a head: "Having gone out to search the field for Episthemon, they found him stark dead, with his head between his arms all bloody. But Panurge said, my dear bullies all, weep not one drop more, for he being yet all hot, I will make him as sound as ever he was. In saying this, he took the head, and held it warm fore-against his cod-piece that the AIR MIGHT NOT ENTER INTO IT, and other two carried the body. Leave off crying, quoth Panurge, and help me. Then cleansed he the neck very thoroughly with white wine, afterwards he anointed it with I know not what ointment, and set it on very just, vein against vein, sinew against sinew, and spondyle against spondyle, that he might not be wry necked: this done, he gave it round about some fifteen or sixteen stitches with the needle: suddenly Episthemon began to breathe, then opened his eyes, yawned, sneezed, and afterwards he let a great ——; now certainly, quoth Panurge, he is healed; and so he was finely, only that he was somewhat hoarse for about three weeks together*."

It is only by a moderate and rational application of this doctrine that our science is to be improved: this property in living parts, of inosculating and uniting again, is indeed so perfect, that we may depend on it with absolute confidence. This doctrine, modestly applied, has improved the practice of of surgery more than any other; for in wounds and operations there are but two great points to be attended to; first, the securing the arteries, so that the patient may be in no danger from bleeding, and then the procuring a speedy adhesion, by which the pain, suppuration, waste of substance, and all the other bad consequences of the wound, are prevented.

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* I leave this in the present edition, that the reader may know how my brother sometimes indulged himself. Under the satire, we always find the right rule of practice enforced.—C.

Upon this principle, we are able to perform things in the regular way of surgery, as surprising as those which passed for miracles in the times when the sympathetic cures were in vogue. In wounds we save much pain, prevent a large suppuration, and great waste of parts, and limit the scar of the greatest wounds often to a narrow and almost invisible line; and in operations, in place of leaving a broad suppurating surface, we make our incisions of such a form, as to leave but a very narrow wound, whose lips touch each other, and unite together with a scar that is very little perceived, and very quickly formed. In extirpating a testicle, in cutting out a cancerous breast, in dissecting away the largest tumours, we contrive, by saving the skin, to cure in ten days, a surface, which, if cut according to the forms of the old surgery, and cured according to the old rule of digesting and incarning the wound, must have taken at least six months.

I would impress upon your minds this rational and moderate approbation of the doctrine of adhesion. Thirty years ago surgeons had no settled ideas concerning it; it was just then rising slowly into importance; they had no motive for saving the skin; or when they had saved it, they did not know how it should be used, nor how much it might contribute to a speedy cure. If they extirpated a tumor, they cut away along with it all the surrounding skin. If they performed the trepan, they performed in a most regular manner that preliminary operation, which they chose to call scalping, or in plain terms, they cut away that skin which should have saved the fractured skull from exfoliation, and which should have immediately covered and defended the brain. In amputating a limb, they cut by one stroke down to the bone; and even when they performed the flap amputation, they dressed their stump and flap as distinct sores. An exfoliation of the bone in these older operations was a thing unavoidable; without the casting off of the bone the wound could not heal, so that in trepan, amputation, and all great operations, where there was a naked bone, it was part of the surgeon's art and skill to procure exfoliation; and the filling up, and final healing of their conical stump, was so slow a process, so imperfect, and so many exfoliations of the bone, with other lets and hinderances intervened, that it is no wonder their imagination was much occupied about the digesting, incarning, and cicatrizing of wounds. Wherever a bone was laid bare, they believed that it must exfoliate before it could heal. Until they saw the exfoliation perfect, till the bone had at least thrown off an outer scale, they would not permit it to heal. They would not lay the skin down in a wound over the shin-bone. If there was a lacerated scalp, they cut the torn piece off; a large part of the scalp cannot be regenerated in less than several weeks or months, and thus they confirmed their opinion by their practice; for very generally in that space of time the whole, or a part at least, of the exposed bone was thoroughly spoiled. These were a few of the mistakes committed daily by the older surgeons, who were well contented with their own theories about incarning and cicatrizing of wounds; too proud of their art, and too little inclined to follow the simple ways of nature.

The discussions which took place among surgeons concerning amputation, and particularly the flap operations, first contributed to the universal introduction of the doctrine of adhesion. The French surgeons, who first invented the flap amputation, declared not only that their flap amputation procured an easy and perfect cure, but that often in three days the flesh of such a stump had adhered. To this O'Halleran replied, with a rudeness and ignorance quite unparalleled. "I would ask," says he, "the most ignorant Tyro in our profession, whether he ever saw or heard even of a wound, THOUGH NO MORE THAN ONE INCH LONG, united in so short a time? These tales are told," he adds, "with more confidence than veracity. Healing by inosculation, by the first intention, by immediate coalescence without suppuration, is merely chimerical, and opposite to the rules of nature." This was the assertion of O'Halleran, himself an excellent and most judicious surgeon; and all the best surgeons of the present day, as Mr. White, Broomfield, &c., have followed his doctrine and practice, viz. that of dressing their circular stumps, with rolls of fine linen laid within the circle of the stump; and when they amputate by the flap operation, they dress the flap and the face of the stump as separate sores till the twelfth day.

When O'Halleran talked this bold uncivil language about confidence and veracity, he little thought that he should live to see the doctrine of adhesion followed by a universal practice of laying down the flap, and the most ordinary surgeon procuring sometimes a perfect adhesion on the third day. But surgery has improved gradually within these twenty years; observations have been carefully made and published in pamphlets or journals; doctrine and practice have gone hand in hand. The particular practice of procuring adhesion belongs to no one person, but has been passing continually from hand to hand, from one friend to another, the common doctrine and discourse of the day; the practice gradually becoming more extensive in its application, has gained strength, like every practical doctrine, by slow degrees. It was applied first to amputation, then to trepan, then to the extirpation of scirrhous mammæ, then to all great operations, lastly to all recent wounds. If we are more particularly indebted to any one man for the application of this doctrine to amputation, it is to Allanson, who, continuing through all his practice to make neat operations, and careful notes, has given us the result in a form and language which makes his writings, notwithstanding the nature of his subject, as pleasant almost as they are profitable to read.

I have been at pains to represent this improvement as gradual and silent, as having obtained by general and common consent, by a slow communication of remarks from friend to friend, till at last the practice was fairly established; and no man could fully claim an improvement, in which every man had some little share. But if surgery be indebted to any particular person for the invaluable improvements which this doctrine of adhesion has brought along with it, it is to Mr. Hunter and the London school.

This universal doctrine and practice of procuring adhesion has done more for surgery in a few years, and most especially for the surgery of wounds, than any other general observation, not excepting even the greatest of all discoveries, the circulation of the blood. It is now well proved that skin will adhere to skin, flesh to flesh, bone to bone, and all these parts to each other. One part only of the human body, cartilage, will not adhere. I have seen many proofs that cartilage does not inflame, nor ulcerate, nor give out granulations, nor generate new flesh, or, at least, it does so very slowly. A wound heals over a cartilage, but not by uniting with it. We amputate a toe at the joint, and the flaps unite in two days; but still they have united with each other only, and not with the cartilage of the joint; and in a luxated limb, we find that the bone continues displaced, the cartilage never inflames, never unites with the lacerated parts, never in any circumstances adheres; for the process of adhesion is really this. Either the arteries of opposite surfaces inosculate mouth to mouth; or, rather, each cut surface throws out lymph, the lesser arteries of each cut surface elongate themselves, stretching into this lymph, and it is thus, or perhaps by the generation of a new intermediate substance, that the continuity and entireness of the part is so quickly restored. If any one point fail to adhere, there the wound must run into suppuration, because at that point there is a separation of parts, which, being equivalent to a loss of substance, requires the generation of new flesh.

When the opposite surfaces consent and harmonize with each other in their mode and period of action, then they immediately adhere; and so skin adheres to skin, flesh to flesh. But if one of the opposite parts enters into a lively action, while the other has only a languid action, and enters into that action slowly and at a long interval of time, the action of the one has expired before that of the other has begun; such parts, therefore, do not conspire nor harmonize in their action; nor can they unite with each other, but they may live and thrive independently of each other; and, perhaps it may happen in this way, that opposite surfaces of skin or muscle may seem to be adhering firmly to the parts beneath them, while they adhere to each other only, and merely cover the cartilage or bone, without having any direct connexion with those parts. The bone (as we see in an old amputated limb), lives and thrives, is not limited in its new formation by the adhesion of surrounding parts, but grows out into a broad knob of callus or new bone. A gristle also (as in an amputated or luxated joint) retains its pure and lubricated form.

There are no doubt accidents both of the constitution and of the wound which will prevent adhesion; for if the patient be of a bad habit of body, if he be lying in a foul hospital, and breathing infected air, if he be ill of a fever or flux, or any general disease, then the properties of the body being less perfect, his wound will not adhere; or if the wound be foul, made with a poisoned weapon, or left with foreign bodies sticking in it; or if blood be poured out into the cavity of the wound (for blood, in this case, is but a foreign body *); or if there be a wounded lymphatic, or wounded salivary duct, a wounded intestine, or a bleeding artery or vein, any of these causes will prevent the immediate adhesion of the wound; or if it be a bruised or gun-shot wound, and there is a destruction of parts, the lost parts must be regenerated, and those parts which remain must enter in a new action for generating new parts, and so cannot adhere.

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* My brother was not a convert to the doctrine of Mr. Hunter of life in the blood. The difference is in the use of terms; every one must acknowledge that the circulating blood possesses properties quite distinct from other fluids: properties which it parts with on the death of the animal or its separation from the body. But when we say it is alive, we must recollect that life in its extended sense is the result of a combination of different influences, and of a reci-

This adhesion, then, is a property of the parts of the living body, which is perfect only while their structure is entire, which operates only where the opposite parts touch each other by the fullest contact, and sympathize with each other in their period and degree of action. Adhesion is interrupted if any foreign body be interposed; it is less perfect in every unhealthy condition of the system; but it is a property of which we are now so well assured, that we look for its good effects in the greatest as well as in the smallest wounds; and the union of a hare-lip, after it has been cut and pinned, represents the perfection of that cure which we attempt in every greater operation, and more confidently in every smaller wound, succeeding sometimes as perfectly after an amputation of the thigh, as after the most trivial cut in the cheek.

This property of reunion in divided parts is proved by every day's experience, to be so perfect, that

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procal action of the several organs of the frame. Even Mr. Himler said that solids, and fluids, and motion, were necessary to perfect life.

One of the practical deductions of Mr. Hunter was, that blood was the bond of union in reunited surfaces. It is not the case, that blood which escapes from ruptured vessels is absorbed, and a new secretion poured out before there is reunion. At all events the rule is absolute. Press out the blood from betwixt surfaces which you intend should unite, and take care that blood shall not afterwards be effused betwixt the surfaces, or you will have no adhesion.—C.

where we do fail (which, no doubt, is sometimes owing to a bad habit of body), we have much reason to suspect some negligence on our own part, some extravasated blood, some open artery, some portion of detached bone left in the wound, or some awkward piece of dressing laid in between the edges of the wound. We have reason, in short, to blame the want of that absolute contact which is so essential to perfect adhesion; for every part of a wound, which does not touch some opposite surface, must suppurate before it can heal; and this is my chief motive for putting down carefully, in short distinct rules, the several ways in which the sides of a wound may be brought together, so as to adhere perfectly.

There is no wound in which we may not try, with safety, to procure this adhesion; nothing surely can be more kindly, when applied to a wounded surface, than the opposite surface of the same wound. It has been but just separated; it may immediately adhere to it; though it do not adhere no harm is done; still the wound will suppurate, as kindly, as freely, as if it had been roughly dressed with dry LINT, or some vulnerary balsam or acrid ointment.

OF SUTURES.

Surgeons have practised all imaginable methods for the uniting of wounds; and very proud they have been of their sutures, and still prouder of the names they have given them. The great distinctions have been, the Sutura Sicca and the Sutura Cruenta, the dry and the bloody suture; the one made with plasters, the other with the needle.

The SUTURA SICCA is made sometimes with gum, as in our common court plaster, which is merely gum-arabic, with a little laudanum added to it (and a very foolish addition this laudanum is), and spread upon black silk. The older surgeons often used glue; sometimes they used common glue made of skins, sometimes fish glue, sometimes whites of eggs; for we find that the aglutinative plasters of the old surgeons took two hours in drying, which shows that they were merely made of glue. But these are dissolved by the moisture which flows from a great wound; therefore, in amputation, and all great wounds, we are obliged to betake ourselves to adhesive plasters, made of wax, resin, and oil; though straps of that kind are far from being pleasant to use; for they must be applied warm; the slightest degree of moisture, on the surface of the adjacent skin, prevents their adhering; they are very hard; and I sometimes observe those straps, in delicate skins, exciting inflammation, which makes the stump, or other wound, gape and turn out its edges. We must have these plasters fresh made, from our larger hospitals, when we are particular in the closing of the wound.

The old surgeons often combined the glutinous and resinous substances in their plasters. They mixed glue, sarcocolla, white of eggs, and mastich: And Fabricius ab Aquapendente was particular in adding gum-elemi, pitch, or gum-ammoniac dissolved in vinegar, by which the compound was prevented from being affected by moisture.

The SUTURA CRUENTA, or bloody suture of the ancients, was of various forms: first, the INTERRUPTED SUTURE; when, in place of making the stitches close and continuous, as in a seam of cloth, they just passed the needle once through both lips of the wound, tied the ligature, and cut the ends away, and repeated the stitch, from point to point, all along the wound, the several stitches of the needle being usually about an inch distant from each other. From this it was named interrupted. It was used on all common occasions; there was always something singular in the part wounded, or in the form of the wound, when they proposed using any other manner of sewing.

Secondly, The CONTINUED SUTURE; when the stitches were made all with one thread close, and succeeding each other regularly, as in sewing a piece of cloth. This is exemplified in the common manner of sewing up the abdomen, after opening a subject. This continued suture was called the Glover's Suture, the Currier's Suture, (Sutura Paripelliorum), the Shoemaker's, or the Tailor's Suture, according to the peculiar manner in which it was performed. It is not used in modern surgery.

Thirdly, When the continued suture was used in sewing up wounds of the belly, it was called GASTRORAPHY; when the same continued suture was used in sewing a wounded intestine (though I cannot find that any such operation ever was actually performed), they called it ENTERORAPHY; and when this suture was made very firm and close, to prevent bleeding, they called it the SUTURA RESTRICTIVA, or SUTURA SANGUINIS SUPPRESSORIA. This was the most absurd and dangerous suture of all. It was not intended for reuniting the wound, but for preventing effusion of blood. They did not sew up the particular vessels to prevent bleeding, but sewed up the general wound so close as to confine the blood. It must have been but a slight bleeding that this suture could restrain; it made a sort of artificial aneurism, by confining the blood. Dionis understood well the absurdity of this Restrictive Suture; for "suppose," says he, "that we could sew any wound so close as to keep in the blood, would it not still bleed inwardly? would not that swell, corrupt, and putrify under the skin, and make it burst out in a sort of gangrene?" A like absurdity to these restrictive sutures did we see in the expectations of those who first invented the flap amputation, for they carved out their flaps from the fleshy part of the leg, not so much in expectation of making a fleshier or firmer stump, but rather with the hopes of suppressing the hæmorrhagy without using the needle; and for this purpose they cut their flaps, trimmed them with dressings of dry lint and flour, then laid them flat upon the face of the stump, and tied them down firmly with buckles and belts *.

Fourthly, The HARE-LIP SUTURE,—so named from its being chiefly used after operating for that deformity,—is one of the few which we have retained. This suture is made by thrusting pins or needles through both lips of a wound, and twisting a fine thread round the projecting ends of the pins, whence it is very often named the TWISTED SUTURE.

Fifthly, When the wound was deep among the muscular flesh, the old surgeons imagined that so large a wound could not be commanded by the common interrupted suture, however deep the stitches might be driven among the flesh; they were besides fearful of using the continued suture in deep gashes, lest the wound should be made to adhere superficially, while it was still open within, forming perhaps a suppuration and deep collection of matter. They be-

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* See Wiseman, who borrowed from the celebrated French surgeon Guido de Cauliaco.

Guy de Chauliac had in his turn copied from the Arabians in most points, and very expressly in this business of sutures.

lieved that a great muscular wound could not be safely healed without a degree of suppuration; while they wished to bring it together at the bottom, they were afraid to close it very exactly at the mouth, lest the matter should be collected in the deeper parts of the wound: it was for this purpose that they used what they called the COMPOUND SUTURE, or the QUILLED SUTURE. It is merely the INTERRUPTED suture; with this difference, that the ligatures are not tied over the face of the wound, but over two quills or rolls of plaster, or bougies, which are laid along the sides of the wound. In performing this suture, we make first two, three, or four stitches of the Interrupted Suture very deep, and then, all the ligatures being put in, we lay two bougies along the sides of the wound, then slip one bougie into the loops of the ligatures on one side, drawing all the ligatures from the other side till that bougie is firmly braced down; next we lay the other bougie, and make the knots of each ligature over it, and draw it also pretty firm; and thus the ligatures, in form of an arch, go deep into the bottom of the wound, and hold it close, while the bougies or quills keep the middle of the wound and the lips of it pressed together with moderate closeness, and prevent any strain upon the threads, or any coarse and painful tying across the face of the wound *.

Sixthly, The fibula or clasp is an old manner of uniting wounds wonderfully little known. The lips

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* Dionis reprobates this quilled suture in very violent terms; but his annotator, De la Faye, says, it is good, especially in deep muscular wounds, and that it was approved of by every good surgeon in his day. This quilled suture we hardly ever use; it is not indeed useful; perhaps in wounds of the belly it might do some service. But we must be careful, by the management of the compress and double-headed rollers, to produce what they aimed at, viz. the compression of the deep part of the wound.

of the wound, instead of being sewed, were laid close together, and then kept in that state by a clasp, which was made thin and elastic, to bend to the shape of the part, and had hooks at each end, which were fixed into the flesh on the sides of the wound. Celsus is supposed to have mentioned these clasps, though some imagine that he meant merely the loops of common ligatures. But the Fibulæ or Agraphs of the French and Latin authors are mentioned in books too near the times of Celsus to leave us in any doubt. It is not unreasonable to suppose, that along with the books, the operations of the ancients were revived by the Arabians, who must also have had traditions concerning the particular methods in use in the times of Celsus. Oribasius, in explaining Celsus, describes the Fibulæ as made of iron, gold, or brass, somewhat in the form of those with which the cloak was fastened. Guido de Cauliaco calls them hooks, small, elastic, and crooked, to take hold of the lips of the cut wound. Fallopius, who says that Celsus meant merely the threads of common sutures, forgets that Celsus, in many places, says, "fibulis impositis, fibulis additis," expressions quite inconsistent with this conjecture*. But whether the fibula was or was not used among the Romans, we know well that it was much in use among the Arabians, and during the first ages of modern surgery. Guy de Chauliac used the clasp; Fabricius improved upon the clasps, and very severe he is upon Vesalius for preferring the common suture with threads. Indeed he argues, with no small degree of propriety, that if the clasps can keep the wound equally close, they will certainly be less painful than transfixing the wound with hare-lip pins, or with a ligature, which always becomes so tense, that, if allowed to remain long, it inflames and cuts its way through the flesh.

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* The clasp is described by Vesalius, p. 982.

Of all these old methods of sewing wounds we have retained three only, viz. the ADHESIVE PLASTERS, the HARE-LIP SUTURE, and the INTERRUPTED SUTURE. I shall now teach you how to use these, according to the size and nature of the wound; and shall be careful to describe the several ways of uniting wounds, in which the skin only, the muscles, the bones, or the arteries, are wounded. These operations I shall endeavour to describe, so as to give each accident the effect of a particular case; and this, I hope, will prepare you in some decided manner of proceeding, appropriated to almost every individual case that may occur.

RULES FOR THE REUNION OF WOUNDS OF THE SKIN.

Except in those cuts which are so slight as only to require a cloth to be wrapt about the part, every wound ought to be united by straps or sutures; for I have observed, that though we put the parts nicely together, with compress and rollers, if the needle or strap have not been used we are never sure of the parts being in absolute contact; we are often disappointed, and, when we undo the wound, find it in a state of suppuration. Wherever the cut is clean, direct, without angles, and the skin not much separated from the parts beneath, and especially when it lies flat and firm over a bone, as on the head, hand, &c. we unite the lips of the wound with a plaster of gum arabic, or common black court plaster cut into slips; and in applying such a plaster, we are careful first to let the bleeding subside; then an assistant puts the lips of the wound neatly together, and we apply one end of the sticking plaster to the skin on one side of the wound, and let it dry and fix itself there, so that we may pull by it; we next pull that edge by the help of the plaster, then moisten the remaining half of the plaster, and lay it also neatly down over the opposite edge of the wound; and lastly, if any one of the slips of plaster have lost its hold, by the oozing out of the blood, we take it gently off, wipe the surface, and apply a new plaster, laying a compress over the whole, which we bind down somewhat tightly with a circular roller, to prevent internal bleeding, support the plasters, and keep the inner surface of the skin in contact with the parts which lie under it.

In larger and more gaping wounds, if we would avoid stitches with the needle, we must use a plaster much stronger than court plaster, which, being made of gum, is washed off by any accidental moisture, as by the unavoidable oozing of blood or serum from the lips of a large wound. The older surgeons pasted two plasters very firmly, one on each side of the wound. The plasters were spread with a composition of colophony, mastich, resin, sarcocolla, &c. mixed with the white of an egg to the consistence of honey, and were allowed half an hour to harden and adhere to the skin; and then, by strings fixed in the edges of each plaster, the lips of the wound were drawn very nicely into contact, and kept so without pain. This was the proper dry suture.

Sometimes we use plasters with strings to support stitches of the needle, or to draw forward the cheeks in operations for hare-lips, where there has been a great separation; and sometimes we use such plasters, with uniting bandages, to support the sides of great flesh-wounds, where there has been considerable loss of substance.

In cuts of the lips or cheeks, much neatness is required, as indeed in all sutures, but here especially, since a slight irregularity in the lip is a great deformity, and a great reproach to the surgeon. In the lip we can have no security but from the firmest kind of suture; the lip hangs loose, and is quite unsupported on its inner surface; it is very dilatable; it moves with the slightest motions of the mouth or jaws; and it is so strongly retracted in laughter and other emotions, by the muscles of the cheek, that it must be particularly well secured. Though some have pretended to reunite the hare-lip by plasters, I know that, even in a grown person, nothing will secure it but the pin. In accidental cuts, we operate exactly as after operations for hare-lip, or for cancer; we take the pin, fixed in the instrument called porte-aiguille, in the right hand, and holding the edges of the lips together with the fingers of the left hand, transfix both lips with the pin, at points exactly opposite to each other, pushing the pin with the right hand, and resisting and managing the lips with the left; we pass two pins, one exactly in the tip of the lip, through the red and fleshy part, (for that secures the evenness and just form of the lip), and another through the middle of the lip, and then twist the waxed thread round both pins firmly, but gently, in the form of a figure of 8.

The first pin should be drawn out the second day, they are usually left too long; and the tension of the pins occasions a suppuration, a puckering of the wound, and a visible scar. Pins are recommended in other wounds of the face, especially in wounds of the cheek; but this kind of suture strains the parts too much, is apt upon any slight inflammation to burst its hold, often it leaves a mark, and is in no case a good suture, except in the single instance of a wound in the lip. Yet, perhaps, in the case of the eye-lid being cut by accident, or by the surgeon for the purpose of cutting out tumours from the socket, the hare-lip suture may be used. In these cases I have used a fine slender sewing needle with great advantage; and indeed I think a common needle, or a glover's needle, which is triangular, preferable to the gold pins*.

In cuts of the face, of the ears, nostrils, or lips, of the throat, or even of the tongue, we use in general a single stitch of the Interrupted Suture; and the cases in which more are required do not often occur, though sometimes we meet with them. A man, for example, whose horse falls with him, being thrown from the horse with great violence, his face lighting among sharp stones, is disfigured with various cuts, each of which requires a separate stitch; or the cut is irregular, of an angular form, and requires a stitch at each angle. Sometimes a sabre cut extends, as it were, along the whole face, or crosses it obliquely; begins in the cheek, crosses the nose, and almost divides the lip. In such a case, we put in a stitch first in the wing of the nose, as being a point the regularity of which we are anxious to secure, then a second stitch near the tip of the nose, with a very fine needle and thread; then a stitch in the angle of the lip, then another stitch to hold up the middle of the lip, then another in the middle of that part of the cut which extends along the cheek; and the gaps between each of those stitches we cross with slips of adhesive plaster. Nor should the surgeon be afraid that these will excite inflammation; it is the reunion of parts that restores them to their healthy state, and effectually prevents inflammation*.

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* In performing the suture on the lip or cheek, you must take care to calculate the degree of swelling of the parts, otherwise the ligatures will be drawn too tight; for example, if immediately after dividing the parts you pass your needles, and apply your threads, the sides of the wound swelling, the whole is too tight, and the needles and the ligatures, instead merely of holding the surfaces in contact, become a source of irritation, inflammation, and consequently of suppuration; the object of the operation is defeated. Therefore pass through your needles, draw the surfaces somewhat rudely together; wait for a quarter of an hour; take off the ligature you have applied, and put on the proper ligature with great care, spreading it wide over the surfaces, so that it may act like a strap of adhesive plaster. The best way of passing the needles is to have them slipped into the split of a piece of wood shaped like a pencil, and the ends of the split wood tied firmly with a waxed thread. You have a perfect command of the needle, and when it is introduced a touch of the scalpel lets it free, by dividing the thread which ties it into the wood.—C.

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* "Whilst I served amongst the Dunkirkers, where Snick and Snee was as it were a fashion, I had much of this sort of work; and, for your diversion, shall set you down one instance in that kind.

"Whilst our squadron rode at anchor in the Groin, there came in some Hollanders, under the notion of Hamburghers, with three ships new trimmed up for the King of Spain's service. A boatswain of one of these ships happened in company ashore with some of our men, where drinking together, the Hollander began to prate of religion, upbraiding one of our men for wearing a cross; and, after a while, growing more heated with drink, he became quarrelsome, and swore Sacrament he would not wear a cross: no, the devil take him! repeating it often. One of our men beat him down, and fell with him; then kneeling upon his breast, and holding his head down, he drew out a knife sticking in his sash, cut him from the ear towards the mouth, then from the os zygoma to the nether jaw. Now, said he, you shall wear a cross, that the devil do not carry you away. I was sent for from the next house as a friend to that religion, and stitched the lips of the wound close together; then sprinkling them with a little pulv. Galeni, applied pledgits with a sarcotic unguent, and with astringents and bandage dressed him up. The next morning he was let blood, and the third day

But the stitching of such a wound requires very particular niceness; and I will endeavour (as far as rules will go) to teach you the necessary precautions: Let your needles be smaller and nicer than they are usually made, less curved, and flat, with two very fine cutting edges: Let your threads also be smaller than they are commonly used, and not so grossly waxed, for that makes them stiff and awkward to draw: Let them be a little waxed, in order to flatten and unite the two threads, but draw them afterwards through your fingers dipped in oil, in order to make them glide through the flesh. Allow the bleeding to cease, be in no hurry. Take a ligature of two threads; pass each extremity of it through a curved needle. The purpose of having two needles is, that you may pass the point from the inside of the wound outwards through the skin. Make a stitch of the needle at each angle of the wound; repeat your stitches, one for each inch in length of the wound; draw them till they make the points approach; and having tied your several stitches, cross each intermediate point with a strap of sticking plaster; and take notice that the ancients were so careful as to close up the whole line of the wound, by pouring upon it a vulnerary balsam, which balsam was not a quackish senseless invention, it was what they called

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after I took off the dressings, and finding the wound as it were agglutinated in the slits, I cut out some of the stitches, sprinkled the wound as at first, and dressed him up with sarcotics, with compress and bandage. The second day after I dressed him again, and cut out the remaining stitches, and in a dressing or two more cured him. This being the work of nature, who rarely faileth in acting her part, if we perform ours in retaining the lips close together, and defending them from fluxion. The patient was well pleased with his cure, though there remained some marks of a cross. These sort of people wearing them with much pride in their faces, as marks of their courage."—Wiseman

Essence of Mastich, or the essence of some other gum; in short it was a spirit-varnish which they poured over the wound; it hardened upon it in the form of a sheath; the part was thus encased in a sort of mould, which was not washed off till after four or five days, when the cure was perfected. Sometimes they varnished the wound with whites of eggs, in place of a balsam. Often they strewed over the wound powders of aloes, myrrh, and mastich; and these gums being moistened from time to time with a little spirits of wine, dissolved first, and then hardened into a cake, so that this was equivalent with pouring the balsam or varnish over the part*.

Although the lip, nose, ear, or chin, be almost entirely cut off, though the part have turned down, and hangs by the smallest portion of flesh, you are not to despair of reuniting it; you are to lay it up again, fix it with a stitch or two, dress it very close, put a pad of soft lint over it, and make all sure with a bandage adapted to the part. It is wonderful how parts will unite after they seem to be irrecoverably separated, insulated to all appearance, and seemingly deprived of any adequate supply of blood.

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* To the intelligent reader this appears a contradiction to what was delivered on the history of adhesion. We see here that the older practitioners did exactly what was dictated by common sense and experience, they put the parts together that they might unite.

Why then was the practice ever different, and how did it come about that any man or set of men should have claimed the merit of uniting wounds by the first intention? The reason is, that if a wound be carelessly or inartificially brought together, mischief will ensue, as deep abscesses and tedious sinuses. These occurring in the practice of surgeons, they attributed them to the too rapid closing of the lips of the wound. Hence the practice of keeping wounds after operation open, that they might heal from the bottom; and this growing into a practice, those who showed it to be wrong and corrected it, had great merit. This piece of history, then, is attended with this advantage, that you obtain the rule, but at the same time you are taught that certain attentions are necessary, or you will have to regret the early closing of the lips of the incision. —C.

If the tongue be partly cut across, as by falling on the chin when the tongue is lolling out, or by convulsions, (the tongue being checked between the teeth,) or by shot, the part which is divided may be joined with a stitch of the needle, while, at the same time, the tongue may be confined with a bandage like that invented by Mr. Pibrac for a young lady, who had several times cut her tongue in fits of epilepsy*.

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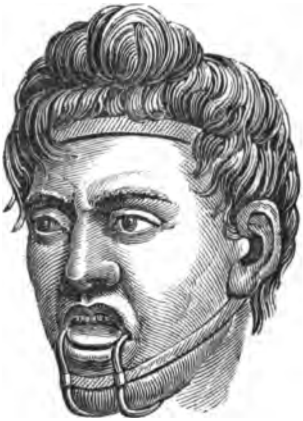
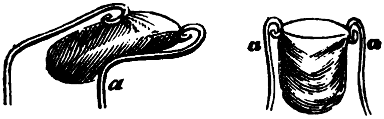
* This drawing represents the bandage which Mr. Pibrac found very useful to him in the case of a young lady who had bit her tongue almost across in a convulsion fit. Observe first, that stitches may be put into the substance of the tongue as into any other part, with perfect success. In this way Paré cured three people who had their tongues almost entirely cut across. And, secondly, that I think a bag of this kind for receiving the tongue, the bag being held back in the mouth with this wire, marked (a a), and fixed by





RULES FOR THE REUNION OF DEEP MUSCULAR WOUNDS.

There is a degree of prudence required in the sewing up of great muscular wounds; for stitches, after all, can support only the edges of the wound, while it is the compress and the uniting bandage that must support all below. Deep muscular wounds, therefore, should be secured chiefly by the compress and uniting bandage. Stitches should in such wounds be used with reserve. Those who have used stitches the most confidently, have been forced as suddenly to cut them out again; a point which is well illustrated by the case of a soldier of the Corps de Garde, who being wounded with a sabre cut, across the shoulder, through the belly of the deltoid muscle,

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a sort of collar round the neck, must be useful both to preserve the tongue, and also to serve as a gag, and prevent more injury in case of a succession of fits; yet I confess, the whole invention savours a little of that trifling manner of which many sensible men accuse the French surgeons; it is perhaps something like what we ridicule in this country by the word nick-nackery; like the needles invented by the French surgeons for sewing the intercostal artery, or the artery of the dura mater; yet if I had not a suspicion that it might on some occasion be useful, I should not trouble you with it.

This plate I preserve in this edition as an example of that ingenuity which is necessary to the successful practice of surgery; but also for another purpose. When parts exposed to much motion and friction are cut or ulcerated, they are difficult to heal, and the continual irritation of motion will sometimes cause the most formidable appearances. This is especially the case with the tongue when ulcerated; and for its protection, and to preserve it at rest, I have used this contrivance of Mr. Pibrac.

I have here struck out a long paragraph, in which my brother had recommended sewing the wounded scalp with the interrupted suture. He confesses that the old surgeons were afraid to do this, and we can attest that the best modern surgeons equally avoid it. It is true that the reunion of the scalp is important, because exfoliation of the skull, or suppuration of the brain, is peculiarly dangerous; but we must endeavour to procure this reunion by the adhesive strap, and by the compress and double-headed roller. We may gain something by putting a single stitch into the scalp, but it is at the hazard of exciting irritation, or even erysipelas of the scalp.—C.

his surgeon sewed the wound that night with many deep stitches; these Mr. Pibrac was next morning obliged to cut, on account of convulsions of the arm, which ceased the moment that he had done so*. Such deep sutures may be fairly enough compared with the cross stitch of Paræus†, which killed the patient, sometimes by convulsions, sometimes by high inflammations, with a total gangrene of the stump.

Yet in all ages it has been the practice to sew muscular wounds. William Clowes, a good old surgeon, but almost as rude as skilful, was among the few in his day who sewed wounds, and he made free use of his needle, however large the wounds. Being at one time highly incensed at the interference of a meddling, bragging fellow, he relates this short case:—"A man travelling out of London to the west country was set upon by robbers, and his two cowardly companions ran off, and left him at their mercy. The chief wound he had was in his thigh, where the muscles were so strangely cut at the heads of them, that he was in great danger of losing the use of that member, the knee-pan having fallen down. Clowes sewed the muscles, and laid all close and right; but because he would not promise that the man should walk perfectly, nor fix on a day by which he would be able to ride home, another surgeon was called, whom Clowes inveighs against, and describes in the following terms: He was an idle bragging fellow, often out of breath in quoting authors to maintain his impossibilities. He cut out all my stitches, and laid the wound quite open, saying, that all wounds should be healed open, and from the bottom. Thus was I condemned of insufficiency, and cozened of my patient, and dismissed thereupon." I do not mean by thus quoting a surgeon two hundred years old, to produce authority against authority, nor put his opinion in competition with that of Mr. Pibrac and the French Academy. I mean merely to show you that such deep stitching is an old practice; it was indeed for occasions of this kind that surgeons invented and used the quilled suture. We cannot but allow that the sewing of deep muscular wounds, when done with discretion, is a good practice, unless we are to allow of this bragging fellow's reasoning, that wounds are to be healed open, and from the bottom. There are but two kinds of wounds which come under this description of great muscular wounds, either sabre cuts across the back and shoulders, across the belly (but not penetrating), across the breast, over the buttock, thigh, &c. or plunges of the point of the sabre, sword, or bayonet. In the first of these, viz. in broad sabre wounds, as, for example, in a cut over the shoulders passing through the rhomboid and latissimus dorsi muscles down to the scapula and ribs, if you allow the wound to suppurate and heal with an interstice, you will find the scar sink very deep betwixt the two edges of the cut muscle. You will perceive that there is a loss of substance, and, of course, a loss of strength, which, not in this case indeed, but in others, may be of great consequence; as, for example, where the bellies of the muscles of the fore arm are cut across, where the bellies of the gastrocnemii are divided, or in the very case just mentioned, where the muscles which extend the thigh are cut across near the knee-pan. Now observe, that where you sew so great a wound as this, it is not with the expectation of the parts absolutely adhering, but if you keep the muscles forward up to one another, and nearly in contact, for twenty-four hours, or a little more, though they do not adhere, they inflame, they are thickened, the whole flesh in the vicinity of the wound is swelled: the blood and lymph are extravasated, the muscles adhere, as it were, to the parts under them; and though they do not unite with each other, they cannot retract. By this alone a great advantage is gained, for if you allow the muscles to retract while they are hot, bleeding, and moveable, and let them continue retracted till the wound is stiff and inflamed, they become fixed in that position; and even the most profuse suppuration will not loosen them again, they must heal with a gap; and besides suffering from loss of substance, they are apt to become useless, by being fixed and knotted in with the skin and with the parts beneath. These are reasons for sewing every muscular wound; as for Mr. Pibrac's fear of the deep stitches causing inflammation, surely at the worst we have but to do as Mr. Pibrac did, "cut them out."

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* Memoires de l'Academie de Chirurgie.

† The cross stitch was a manner of holding the opposite surfaces of an amputated stump in contact; it was made with a great needle, like a seton needle, with a ligature, generally of a pretty broad tape or knitting. It was passed across the face of the stump in two opposite directions, the one tape crossing the other in the centre of the stump, whence it was called the cross stitch.

If then the muscular wound be broad, you must draw it together with such stitches as its size and the mass of parts you have to support may require, trying also to help these stitches, and relieve the strain of the parts by plaster, compress and bandage. If the wound be deep and wide, but without any great vessel wounded, if there be no extravasated blood, nor any thing particular to hinder the adhesion at the bottom of the wound, you may venture to put in one or two stitches, hoping, that if the wound adhere in the lips, it may adhere also within; you may also rest assured, that if it do not adhere at the bottom, the adhesion nearer the mouth of the wound will not make great progress, and can do little harm. If the wound be exceedingly deep, as that made by the stab of a sword, or of a pike or bayonet, you must not think of stitching it, for the mouth of such a wound bears a very small proportion to the wound; you have no command on the wound by any stitch with which you can stitch the lips of it; this is a wound fit rather for the process of the secret dressing; you squeeze it, wash it, suck it if you will, and you trust entirely to the compress: you put a compress upon the mouth of the wound, and if the blade have passed slanting along, you must lay a long compress wherever you think it can have any command of the wound, so as to put its sides in contact with each other. Gentle pressure is peculiarly useful. This is the proper case for using the uniting bandage*.

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* This passage requires some comment. Nobody knew better the necessity of studying position, so as to relax the wounded muscle, yet it has escaped my brother in writing this passage. By placing the limb so as to relax the divided muscles, there will be no necessity for stitching them. Thus I have seen the biceps muscle of the arm divided, and when the arm was bent, the extremities of the muscle were not only brought together, but they were forced out and protruded from the wound.

Indeed the suture is in no circumstance necessary, unless in parts where you have no firm support beneath to apply the uniting bandage. The abdomen, the lips, the cheek, the eye-lids, require stitches, but no other part of the body.—C.

RULES FOR THE REUNION OF COMPLICATED WOUNDS, WHERE THERE ARE WOUNDED ARTERIES OR FRACTURED BONES.

This principle of adhesion prevades all surgery, and is to guide us not merely in simple wounds, as cuts of the face or head, or lacerations of the scalp, but also in complicated wounds; and I tell you further, I have been at this pains in explaining adhesion, because it is the great practical doctrine in surgery, as inflammation is the chief surgical disease; and you are to keep adhesion always in your thoughts, both in simple and in complicated wounds, not in the first moment only, but throughout the whole cure: you are to have this doctrine of adhesion in view, even where you are sensible that it cannot entirely succeed.

By complicated wounds, I mean those where the arteries are wounded, the joints opened, or the bones cut and broken, and protruding out of the wounds.

In cuts of the wrist, where the radial artery is wounded, or in cuts near the bend of the arm, where many great blood vessels are concerned, or in wounds of the neck, or of the ham, or in the fleshy parts of the thigh, we are often too much occupied with the bleeding, and with the important business of securing our patient from immediate danger, to think of the means of procuring adhesion and a speedy cure. But this is allowing ourselves to be distracted by the hurry of an operation, a thing very unbecoming in a surgeon: We should judge deliberately, and act coolly; we must be careful to perform both operations at once, both that by which the bleeding is suppressed, and that also by which the wound is to be reunited. First, We let go the tourniquet from time to time, or lift our fingers from the mouths of any vessels that are bleeding smartly: we tie each of these regularly by means of the tenaculum, and when the arteries are tied, after the general oozing of the blood has also stopped, and the wound become dry, we perform the second part of our operation, viz. uniting the wound itself. If it be on a hard and bony part like the wrist, we lay the lips close together. Generally in this kind of wound, compresses well applied, and a neat roller, will keep it sufficiently close without stitching.

Where considerable vessels are wounded, we first apply the tourniquet, then tie the arteries; then undo the tourniquet to see that the arteries are really secured; let there not be even an oozing of blood to interrupt our next operation, viz. the closing of the wound; then unite the wound according to its nature and size, leaving the ligatures of the arteries hanging from a corner of it; and though perhaps the whole will not adhere, yet much will adhere, and we always have our chance of procuring a total adhesion. The ligature keeps a little part open for itself, with a slight suppuration round about it, but attended with no pain, and it comes easily away on the fifth or sixth day.

When the bone is wounded, or cut, still we pursue our great intention of uniting this complicated wound also, for the bone often adheres, and very probably the reunion proceeds after this manner. We put the bone into its place, and cover it with the skin, keeping all the parts in close contact; the skin adheres to the skin; the bone itself most probably does not, in the strictest sense, adhere to the bone, or at least its adhesion is different in its period, and in its manner, from that of the soft parts. And yet the adhesion of the bone resembles that of the skin, for the outward wound closes; the wounded bone throws out its secretion; that secretion becomes vascular; then bone is secreted; a kind of callus is formed for uniting the cut bone. It is very particular, that in all fractures, great as well as small, and, of course, in all wounds of the bones, the bone never heals till the outward wound is first healed up, so as to restore the continuity of the vessels, which must be made perfect again, before the secretion of bony matter can begin. If a wounded piece of bone still preserve its connexion with the soft parts entire, it adheres again, lives, and is reunited, and the general wound is made to adhere as firmly, having a cut bone in it, as if it were a simple wound! How otherwise could we make the surfaces of an amputated stump adhere, it being the largest wound, having in its centre the largest cut bone? Therefore, when by a cut of the sabre a bone is divided, when, for example, a man defending his head receives the wound in the fore-arm, and has the ulna cut clean through; or even when both the bones, both radius and ulna, are cut across, so that the hand has fallen on one side; if but one of the great arteries of the fore arm remain entire, the hand may be saved; and in order to accomplish this, the ulnar artery, if cut, must be tied, the bones set, by laying the fore arm on a firm splint; the wound itself must be sewed with two or three stitches of the needle. The saving of such an arm so cut across in the middle of the bones is much easier than when the wound is complicated with an opening into the joint. When a piece of skull is cut up with the sabre, if you put it down again along with the flap of the skin, which it is still attached to, you will find that the bone is so entirely nourished by the pericranium, that it will continue to live, will adhere, and will resume its connexion with the skull, just as the flap of the scalp resumes its connexion with the soft parts. The process of reunion is the same in a wounded arm*.

The surgeon is apt to be alarmed beyond measure at seeing a member almost separated; the thumb of a workman cut off by his tools, and hanging apparently by nothing but a piece of skin; the tarsus cut almost across by the stroke of the adze or axe; or the wrist-joint cut open by the stroke of the chisel, or almost cut off with a sword, the hand hanging all on one side; or an ankle twisted and almost torn away by machinery, the foot cut nearly away, hanging to one side, the joint opened, and the arteries bleeding. But in all such cases the surgeon must guard himself against the first impression; he must never be in haste to cut such separated parts away, because in the hurry of the moment he is but an ill judge of the proportion of life and circulation which the part may retain; he cannot decide at once whether the part will or will not live; and the part, though separated and dead, by being applied to the sound and living parts, can do them no harm. He should consider always, that if he is to preserve the part, it is by adhesion only, and he is to use all the common means of procuring adhesion. He is not (as I have too often seen done) to lay a limb thus mangled, and which he has some expectation of saving, in a great slush of poultice. The process for saving the hand of a workman, when thus mangled with his tools, is this: you are to take up the arteries first, then return the bones into the wound if they project, stitch the skin over them*, draw together all the open spaces with slips of adhesive plaster, dress the outside, not with an emollient fomentation, or a clumsy relaxing poultice, it must be moistened all over with camphorated spirits, by dipping pieces of lint in the spirits, and laying them along the wound. You are then to wind a roller gently round the part with moderate tightness, in order to keep all firm; and finally, if the joint, as the wrist or ankle, be wounded, you are to lay the part out upon a splint†, as if it were a fractured limb, and keep it constantly covered with a cold spirituous lotion.

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* This is theoretically true, but in practice dangerous; and I think it better to cut off the piece of bone which hangs by the integument.—C.

The more complicated the case, the more anxiously should we desire to reunite the wound. We extend this principle even to COMPOUND DISLOCATION, which is the worst kind of wound; for in such cases the bones being protruded, the joint being burst up, the capsule torn, and the heads of the bones being displaced and exposed, if we merely return the bones into their place, we do little; the parts are still so far separate that they cannot adhere; they must inflame. It is not from the air getting into a joint so injured that we have pain, swelling, profuse suppuration, and such destruction of substance as endangers the limb, but it is because the parts are suffered to remain separate; for let me once more remark to you, suppuration must come on wherever parts are not joined. By trying to procure reunion of the soft parts in a compound fracture, you will not always succeed; you cannot expect to cure it like a pure incision of the skin, nor like a wound of the axe or sabre, which divides the bone or the joint with a clean cut, without destruction of parts. Assuredly, in proportion to the destruction of parts, and the violence of the bruise, your chance of reunion is lessened; but even the smallest chance is not to be thrown away. You know, that when the scalp is torn by falling among stones, or by the wound of a bludgeon or of a stone, the parts are so injured that they must inflame, they cannot reunite immediately nor perfectly; the case resembles, in some degree, a gunshot wound; yet such lacerations of the scalp very often are made to adhere partially; and at any rate, if the wound should inflame after being placed in contact, you have warning of the approaching danger, and can free it in good time. So, in compound fractures, even in the wound or laceration of a joint, you are not merely to return the protruding bones; you must lay the lips of the wound, lacerated as they are, as fairly in contact with each other as may be; you must put a little dry lint over the wound itself, and lay soft rolled bolsters of lint upon it, so as to support each of the swelled lips; and keep them close; to your own discretion I must leave it to put in a stitch, or to refrain from it, according to the exigency of the case; but where there is the least chance of escaping suppuration, and procuring reunion, I should advise you to use the needle; for I have seen one or two stitches save the hand of a workman.

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* In such cases the suture is quite necessary. Such wounds I cover with the balsam of Peru, dipping the lint in it, and laying this over the stitches and straps.

† A man, in stepping out at a door where a servant was cleaving wood, put his foot upon the billet, just as he was about to redouble his stroke, and the axe went through foot and shoe and all, and the edge of the axe stuck deep in the wood; so that nothing remained undivided of the foot except the last bone of the tarsus, viz. that which supports the little toe. All the vessels being cut, there was of course a great hæmorrhagy, and the man fainted, which happily stopped the bleeding.

The two parts of the foot were put together, and secured with compresses, splints, and a roller; and the man was so thoroughly cured, that when he wanted to satisfy his friends of this at any time, he could stamp with both feet very loudly, and so equally that you could not distinguish the sound foot from that which had been divided across.—See other good cases in La Motte.

A slater having fallen from the top of a house, four stories high, upon the pavement, had his life saved by lighting fortunately upon his right hand, which sustained the whole force of the shock in such a manner, that even his head had not touched the ground; and there was no other injury, except the luxation of one of his ribs from its cartilage. The wrist joint was entirely torn; the radius, which of course received the chief part of the force (being the only bone that is properly connected with the bones of the carpus), was terribly shattered; the joint was burst up with such violence, that the hand hung quite on one side towards the radius, and turned as it were upon a point; the small end of the ulna, with its styloid process, projected through the wound, and the hand looked as if spitted upon this bone; the hand was shortened by the manner in which the radius had yielded, for it was shattered and broken into small fragments; and so violently was the hand distorted, that the head of the radius was turned out at the wound, though the wound was chiefly on the opposite edge of the fore-arm, viz. that next the little finger; along with the radius, one of the carpal bones projected through the wound, quite separated. I cut off the end of the radius with the cutting pincers of an amputation case; I dilated the wound with the knife, and I took up one of the arteries with the needle; I snipped away the carpal bone with the scissors, for it hung only by a rag of tendon and skin. I turned the hand right upon the remaining part of the fractured radius, laid the palm of the hand and the flat inside of the fore-arm upon a firm splint, made a stitch in the lacerated skin of the wrist, to hold it together, and finished by laying a large flat sponge upon the open part of the wound, just a little moistened in spirits, so as to make it spongy, soft, and pliant. This closed the laceration so smoothly, that almost the whole of the integuments adhered; the part which failed to adhere was of no great extent. The matter from it was in small quantity and good. In three days it was plain that the hand was safe, and that there would be no gangrene. In about fifteen days the swelling had subsided, the suppuration had become very good, and the parts so close, that it was likely the callus was beginning to form.

This man was about three months under my care; but it was rather on account of the knotty swelling which surrounded the wrist, and which was very hard to discuss. But at the end of that time the callus of the radius was so firm, that he could use his hand pretty freely; and, what was little to be expected, the joint also was restored. He recovered the rotation of the radius, as well as the bending motions of the wrist; and now he finds his hand perfectly useful and strong for work.

There are certainly cases where it were a folly to use the needle, especially where parts are too much lacerated to lie equally together, too much bruised to escape suppuration. We cannot expect that all disordered parts should adhere, but yet a partial adhesion is often of much importance, and may save the part; and though we cannot, with any degree of prudence, use the needle,—the regret of not being able to use it rests upon our mind,—we try to make up for this by laying the parts smoothly together with soft sponges, and little bundles of lint; we also apply slips of lint dipped in spirits, but no poultice, unless where we give up all hopes of saving the member by adhesion.

But there is one case, and perhaps only one, where adhesion is physically impossible, and that is the case of a gunshot wound; for there the parts are not merely hurt and lacerated, they are so bruised by the ball that they are killed, totally deprived of life; and a partial gangrene, and a sloughing of the mortified parts, must precede the cure of every gunshot wound. It is only after the sloughing, and during the granulation of the wound, that the parts can adhere; and they adhere not at once, but slowly and successively. These peculiarities naturally forbid stitching a gunshot wound, for that would but raise the inflammation higher, and increase the loss of substance. But we have every motive, especially where flaps of skin or muscle are torn up by splinters, to bring the parts closer and closer, as the sloughing proceeds, in order to give each point, as it resumes its healthy action, a chance of renewing its connexion with some adjoining parts; and thus there are certain cases, where a judicious surgeon, departing from the established rule, will venture to put a stitch in a wound, when the parts are lacerated by gunshot or splinters, drawing up the points, not so close and firm as in other cases, not with any expectation of the wound uniting by adhesion, at those points where it is sewed, but with the design merely of supporting a ~~flap,~~ in order to preserve it, and keep it nearly in that direction in which he would like to have it to adhere; for it does adhere in the second period of the cure, when the sloughing is over, and the parts begin to reunite.

Even in wounds of the belly and breast, it is adhesion of the parts inwardly wounded which saves the patient. It is quiet, perfect silence and composure, and the natural powers, that bring about this adhesion. You lay the mouths of the wound gently and softly together; you wait patiently the event of this natural process; you can do little to assist, but you must do nothing to disturb this process. Many a patient died, in the times of the old surgery, by their thrusting tents into the wounds of the belly and breast; and even now we are too apt to disturb and do harm, by an unmeaning and too curious probing of such wounds.

The last direction which I have to give you relates to the approach of inflammation and separation of the wound, for I cannot allow myself to call it inflammation when the part adheres; this indeed were no better than to call a cure a disease.

The adhesive inflammation (for it is called inflammation) is not attended with fever, pain, swelling, nor redness, unless in the most trivial degree; that gentle swelling which indicates the fulness and strong but healthy action of the vessels, an adhering part must have; but this increased action of the vessels, during the reunion of the lips of a wound, stands on the same footing with the healthy action of vessels in forming, or in supporting any part of the system. A bone, for example, is formed and completed by the natural action and fulness of these arteries which are destined to produce it; a spoiled bone is regenerated by an increased action and fulness of the same vessels; the callus which reunites a broken bone is formed by a full but slow and regular action of these arteries, which extend from each end of the broken bone, and meet each other; and whenever vessels, extending either from the ends of a broken bone, or from the edges of any wound in the soft parts, meet each other, the part is entire again; they form a perfect system of circulation; from the very first moment of adhesion the vessels of a wounded part resume their healthy action, unaccompanied with inflammation, swelling, or pain; the part is once more entire and sound. If the vessels become thus entire from the very moment of their reunion, if neither pain nor swelling come on, unless the process fail, how can this process be called a disease? Or by what sophistry can it be comprehended under the definition of an inflamed part? To speak thus appears to me an incorrect and unfavourable view of the matter; it is to describe the cure by the very name of the only disease which can interrupt the cure. I must therefore consider the part as going on in a sound action, while it continues to adhere, and shall proceed in describing what is to be done, if the wound should begin to separate and open, or, in other terms, should begin to inflame.

Adhesion prevents inflammation: when the parts adhere they enter into a healthy action; they are entire, and they do not inflame. Whenever any part is not in contact, and does not adhere, it must inflame: if one point of a wound be left thus separate, its inflammation may extend to the adhering part of the wound, and so one point left thus separate endangers the whole. The stitches, if imprudently made, if drawn too tight, or made too frequent, or made with too coarse a ligature, are themselves a cause of inflammation; inflammation disposes the wound to burst open again, and so the inflammation around the pins or stitches endangers the whole; and sometimes the timely undoing of such stitches prevents this opening of the wound. If there be blood poured out under the wounded part of the skin, it acts as a foreign body; it separates the skin from the parts below, which is exactly equivalent to the separation of the edges of the wound itself: this also endangers the whole. From all which, you will conclude, first, that whatever prevents the perfect application of the wounded surfaces endangers inflammation. The moment you observe pain, inflammation, and swelling of the wound, a separation or gaping of its lips, the stitches tense, and the points where the stitches pass particularly inflamed, you ought to undo your bandages, draw out your pins, cut your stitches, and take away every thing that is like stricture upon the wound. These prudent measures may abate the rising inflammation, and prevent the total separation of the skin, while you may still endeavour to keep the wound tolerably close, by the more gentle means of sticking plasters.

But should the inflammation rise still higher, and should you perceive that a total separation and turning out of the wound is inevitable, you must throw all loose, put a large soft poultice round the whole, and forsake, without hesitation, all hopes of procuring adhesion by the first intention, as it is called. Should you, in this critical juncture, persist in keeping the parts together with sutures, the inflammation would, in the form of erysipelas, extend itself over the whole limb; attended with a fœtid and bloody suppuration, wasting the skin with great loss of substance. Therefore throw all loose, foment, apply your poultice, allow the wound to separate in its lips, and to pass slowly into a soft and easy state of suppuration; and then a second time try to bring the edges up to one another, not by stitches, but by adhesive straps, or by a gentle bandage.

DESCRIPTION OF THOSE WOUNDS WHERE ADHESION IS NOT EASILY OBTAINED, AND OF THE ACCIDENTS BY WHICH ADHESION IS HINDERED.

I fear I cannot have recollected all the rules that may be needful for you; but if I have taught you the general principles truly, you will be able to add whatever may be wanting, and to accommodate the rules which I have delivered to the circumstances of each particular case; and yet it is perhaps necessary to recapitulate and explain the various accidents which will prevent adhesion. A wound will not adhere where there is much loss of substance, where it is difficultly drawn together, where the parts are put upon the stretch, where the edges are not completely opposed to each other, where there is a necessity for many and deep stitches, firm ligatures, or a tight bandage; for in those circumstances the surfaces inflame; and whatever parts inflame cannot adhere, neither will the parts adhere when the wound is great, for that is of course equivalent to loss of substance. Thus I remember to have seen a stump more cruelly sewed than even by the cross stitch of Paræus: it was sewed with seven great hare-lip pins made on purpose; and though the lips of the stump were easily brought into contact, the stump, from this cruel operation, fell into total mortification on the third day.

When the wound is deep it does not always adhere; stitches do not go to the bottom; the deeper parts remain full of blood, and unopposed to each other; the sewing up the mouth merely of such a wound must do more harm than good. A gunshot wound cannot adhere, both because the deadening of the parts is equivalent to loss of substance, and because, until the sloughing be over, the dead parts within the wound prevent the contact of those which are alive. If stitches are imprudently used in a gunshot wound, and drawn tight with the intention of procuring adhesion, they must burst out, because a gunshot wound swells, as a prelude to the throwing off the sloughs. A foreign body lodged in a wound generally prevents adhesion; for though the foreign body be far down, at the very bottom of a deep wound, it inflames the extremity of the wound, and that inflammation extends along the whole tube. Wounds heal sometimes over balls and other foreign bodies, but they heal very slowly and imperfectly. If there be an effusion of blood into the cavity of a wound, that still more certainly prevents adhesion, both as it keeps the parts separate from each other, and as it acts like a foreign body, in distending, irritating, and inflaming the wound. But the circumstance of the surface being kept in any degree separate is, of itself, a sufficient cause of a wound not adhering; for parts kept separate must inflame; when they inflame they cannot unite; and therefore, a ragged and lacerated wound, as the wound made by the crushing of great stones, of mill-wheels, or other machinery, the bite of a horse, dog, or other animal, cannot easily adhere, because, from the irregular laceration, no one surface corresponds with another; and since the surfaces cannot be put in nice contact, point to point, they must inflame, cannot adhere, and must fall into suppuration. Often the inflammation of a bite excites terrible apprehensions lest it should prove to be the bite of a mad animal, though in ninety-nine of a hundred cases it is from the laceration, from the irregularity of the wound merely that it will not adhere.

The manner also of uniting a wound may be so faulty as to cause inflammation; for if it be left still bleeding at the time it is stitched, if a piece of bone, loose and quite detached, be left in the wound, if part of the skin be turned inwards when it is sewed, if the stitches be too frequent, as in the continued suture of the ancients, or drawn too hard, as in what they called the restrictive suture, for restraining the blood; if the suture do not gently support the lips, but bear upon them with a painful straining; then the stitches themselves are as foreign bodies; the inflammation appears chiefly where the stitches are; and if to these faults be added that of binding a roller too tight round the part, the whole member swells the first day, the skin around the stitches is inflamed the second day, and if they be not slackened, or altogether cut out, they burst on the third, and the lips turn out: the wound opens, an erysipelatous inflammation comes on, the parts suppurate with great retraction and waste of substance, and it is fifteen or twenty days before we can make another attempt to close the wound, by bringing up the lips of it gently with compresses and bandage.

But the worst case of all is, when stitches are imprudently made after a wound has already become inflamed; for that is just like the imprudence of cutting off a limb after a gangrene is begun. We may cut off a limb to prevent gangrene; but if the gangrene be already begun, and we cut off a limb, the gangrene, far from being interrupted, will rather be hurried on to its fatal termination. In like manner we may use stitches, in order to prevent inflammation, by reuniting a wound; but if the wound be already inflamed, and the time for prevention be past, then stitches, as they cannot unite an inflamed wound, will hurry on the inflammation to its greatest violence. For I must venture once more to observe to you, that stitches are meant to prevent inflammation, not to cure it; that stitches made while the wound is still fresh reunite the vessels, which, being joined again, soon fall into a calm and healthy action; but if inflammation be once begun it will not cease. Stitches put into a sound part prevent inflammation; but if driven through an inflamed wound, they increase the disease, and may bring it into a state of gangrene.

An unhealthy constitution is unfavourable to the healing of wounds; but under this head I do by no means comprehend a scrofulous habit of body; for in such habits there seems to be a lively action in the skin, accompanying its lively complexion, which disposes it to heal very quickly; so that although, from the slow suppurations of scrofulous glands, we should apprehend that in any such constitution an accidental wound should be very difficult to heal, we yet find, by experience, that a clean cut in a scrofulous person heals with peculiar ease. The unhealthy constitution which I mean is that which is marked by weakness; and it is very strange, that men should continue to argue and practise as if a bad sort of inflammation arose always from high excitement, and from that alone; he must have observed little, who is not satisfied that it arises, in by far the greater number of cases, from a very opposite cause. It is in unhealthy and weakly constitutions that wounds refuse to unite; and they burst out the instant that any cause of sudden weakness affects the general habit. If a man be scorbutic, syphilitic, or feverish, ill fed, ill clothed, exposed to cold and moisture; if he be laid in a foul hospital, prison-ship, or jail; if he be a prisoner when wounded, depressed in spirit, weakened in body, exhausted with fatiguing marches, confined with many of his fellows in some damp and noisome prison; if he have lived long in an unhealthy camp, or in a hot climate, any wounds he may have will not unite; or if his wounds have been well and neatly united, and have begun to adhere (but have yet adhered imperfectly), they inflame and burst out again, the moment that these circumstances affect his general health: no sooner is he seized with purging, dysentery, fever, or the fits of an old intermittent, than his wounds open afresh. It is debility that causes this inflammation and bursting of wounds; it is debility, either habitual or suddenly produced, which converts wounds into malignant sores; and as scurvy, when it makes its slow progress in the system, ulcerates the gums, opens old wounds, and even dissolves the callus of fractured bones; in like manner does any cause of sudden debility affect a wound, and makes it swell, inflame, and burst its sutures.

This reminds me of telling you, in the last place, how important it is to procure adhesion in the very first moment of a wound; for the longer this is neglected, the less is the part disposed to heal. A speedy adhesion saves pain and inflammation, prevents suppuration, wasting of flesh, a wide scar, and all the other deformities and distresses of an ulcerating wound. It prevents more serious ill consequences than pain and deformity; it prevents that bursting of arteries which is so apt to happen in an ulcerating sore, or that oozing of blood which is so much more difficult to command than the most impetuous bursting of sound arteries, and which is always an omen of something still worse approaching. The speedy adhesion of a wound prevents sleepless nights, diarrhœas, fever, and wasting of the flesh, and the accession of the hospital fever, or hospital sore. You do not know, after a battle, how soon your patient may be thrown into some foul hospital! nay, even in a stationary and well regulated hospital, your patient may be seized with hospital fever, dysentery, or some other disease. If you once get the adhesion thoroughly accomplished before any such misfortune happen, your patient is, in some degree, safe; if you neglect the first moment of healing his sore by adhesion, it may never heal; if he lie but a few days in a foul hospital with an open wound, that wound becomes a sore; the sore is followed with diarrhœa, foul tongue, nausea, and thirst; he becomes sickly; the sore degenerates, he falls into a fever, and dies; his safety, his life, turns upon this single point of procuring adhesion.

Thus, gentlemen, have I laid before you a short history of the rude and cruel practices of the older surgery, and the first dawnings of this doctrine of adhesion; its general importance in our profession, and its final application to wounds and operations: by it we perform cures more sudden and wonderful, than those which were of old achieved by the secret dressings and sympathetic powders. These which I have laid before you are the CANONS of MODERN SURGERY, which stand in place of those rules which inculcated the mundifying, incarning, and cicatrizing of wounds.

DISCOURSE III.

OF ILL-CONDITIONED AND COMPLICATED WOUNDS; OF ULCERS, BANDAGES, AND THE DAILY DUTIES OF AN HOSPITAL SURGEON.

In this chapter I have to speak of the consequences of wounds, as you see them when you enter a great hospital, in the wounded collected after a battle. A very few words will be sufficient to convey to you all that systematic authors give us on this subject.

An abscess is that collection of purulent matter which forms in the cellular texture of a part in consequence of inflammation. If the abscess be formed in consequence of what is termed a phlegmonous inflammation, the side of the cavity is coated with coagulable lymph, and the matter is confined within pretty regular limits. But if the abscess be formed by a lower and more languid, chronic, inflammatory process, and in a scrofulous constitution, the pus is thin and unhealthy, and sinks through the cellular membrane from cell to cell, gravitating and not confined by any process of adhesion.

Be it remembered, then, that in all conditions of wounds, the surgeon is to have two objects perpetually before him; the first is attention to the general health and condition of the patient; the second is the management of the wound.

The suppressing hæmorrhagy in all dangerous wounds, or the providing for adhesion, is the first great business of the surgeon; but the preserving the health during a tedious cure, the alleviating pain, the preventing suppurations, the procuring the reunion of broken bones, the healing of fistulas, and the curing ulcerated, ill-conditioned wounds, are his daily duties: they are important duties; and if I be not greatly deceived, require more industry, good sense, and professional knowledge, than is usually imagined.

The curing ill-conditioned wounds is a wide and important department of surgery; for under this class we must reckon almost all wounds which do not immediately adhere; all complicated wounds; all those where the blood has been driven inwards among the muscles, where the great arteries are injured, where there is much searching and cutting up of the member, before the bleeding arteries are found; where arteries burst out from time to time, injecting the parts with blood; where the joints are injured, the bones much broken, or where, though the bones are not much broken, the flesh which lies deepest has been sorely bruised against the bones, so as to fall into inward suppuration, accompanied with great swelling of the limb.

Gunshot wounds, even in the least dangerous places, though merely in the flesh, are also to be reckoned among complicated wounds, because the ball passes with a velocity to cause mortification or death of the part touched; they cannot adhere, both as being gunshot wounds, which are unavoidably attended with mortification and destruction of parts;

and as balls or other foreign bodies are often lodged deep in the flesh. In such cases the wound, though it cannot heal, yet tends to heal, by which its tube becomes firm, solid, and callous; it pours out a thin ill-digested matter, and so degenerates into a fistulous sore.

I have thus described slightly a class of wounds, which it were difficult or impossible to define: the term complicated, ulcerated, or fistulous wound, comprehends an infinite variety. Yet it is of singular importance to you that I should, in the opening of this discourse, lay before you, unequivocally and plainly, the nature of that case which I am about to explain; I am now to explain to you, not any one individual wound, but the various disorders of a swollen ill-conditioned limb. I am to suppose you entered into the wards of an hospital, looking around you upon limbs variously wounded, but all of them lying out, swollen, suppurating, fistulous, rotting in their own filth, having carious bones, bleeding arteries, and a profusion of matter; the patients exhausted in the mean while, with diarrhœa, fever, and pain.

If all the ill-wounded limbs in an hospital fall into this condition, the disease may almost be considered as one particular case; and I shall now endeavour to explain to you how much of this disorder is to be ascribed to the unskilfulness of the surgeon, and what part of it arises from the essential nature of the wound. I will endeavour to instruct you in all the daily duties of an hospital, and those are always the most essential duties. I will suppose you as young surgeons, intrusted with a most important charge; going your rounds through your department of the hospital; observing the condition of each wounded limb, and trying to discover what particularly can be done for each; and followed by the nurses, mates, or dressers, with all the necessary apparatus of sponges, rollers, injections and ointments, setons and caustics.

If a wound be open, superficial, large, and wide; if it be a lacerated wound, such as cannot be reunited; or if it have been stitched, but without success, swelling and inflammation comes on with intense pain and fever; suppuration ensues; the wound degenerates into an open sore; but is rarely accompanied with intense swelling, or any general disorder of the limb.

If a wound be deep and narrow, passing down into the muscular parts; if it be made by musket-shot, and especially if the shot be lodged among the deeper parts, the whole limb inflames, swells, and falls into a general suppuration; and from the critical moment in which it suppurates, every thing depends upon the skilfulness of the surgeon. A limb so wounded, being committed to the care of nurses only, or of ignorant young men, must go wrong; the matter collecting, works its way forwards unobserved, till at last the cellular substance is entirely destroyed, the muscles undermined, the bones insulated, surrounded with matter, and thoroughly spoiled and carious. The flesh, skin, and cellular substance of such a limb, are all macerated and softened, the bones are exposed and dead, and the whole limb lies a shapeless mass of suppuration; it is irrecoverably diseased; it is inflamed, fistulous, verging towards gangrene, or soaking in suppuration; the health and strength decline rapidly; thence comes on the question of amputation; and that limb which might so easily have been saved, is in danger of being cut off.

When a limb is perforated with balls, or battered with great shot, or crushed in machinery, so that its bones are broken, perhaps protruded, its great arteries wounded, and all its fleshy parts, all its deeper muscles, bruised inwardly against the bones; it often falls into gangrene on the first days; or (if the patient escape the first danger) into universal inflammation: the whole limb swells to that enormous degree which threatens gangrene; some parts are very highly inflamed, others slightly gangrenous; the cellular substance, and the interstices of the muscles, are filled with extravasated serum, or blood; and in consequence of this extravasation of blood, the suppuration is dark coloured, fœtid, and very foul; the skin is much destroyed, the openings numerous and fistulous, the bones carious, the fleshy or muscular parts of the limb wasted; these are inevitable dangers arising, not from the carelessness of the surgeon, but from the essential nature of the wound. Thus would I represent to you the various forms of a complicated wound; the diseases which ensue are among the most important in surgery, and, at the same time, the most neglected; surely, if any skill or conduct can save a limb from falling into this condition, that conduct and the knowledge which it implies, must form a very serious part of the duties and learning of a surgeon,

Let us, first, then, consider the way in which the most simple wound may degenerate thus. When the adhesion fails, the wound inflames, and all the means which have been used for uniting the wound serve but to make it open so much the more; you undo your bandages, take off the adhesive plasters, and cut out your stitches. You throw all loose, foment and allow the lips of the wound to separate from each other, and fall into a soft and easy state of suppuration, and lay the limb in a large emollient poultice. But when the young surgeon extends this good rule, to the suppurating or second stage of such a wound, he mistakes the intention, and offends against reason and common sense; the suppuration is itself a disease which he should yield to only for a moment; for no sooner is the suppuration established, and the state of the wound determined, no sooner does the first inflammation subside, than the wound falls next into a state of relaxation and weakness. The violent action of the vessels has ceased, the danger of gangrene is past, and there is established a new disease; it is now a low inflammation and profuse suppuration which you have to combat; and the swellings of the limb, collections of matter, frequent suppurations, spoilings of the bones, and destruction of texture among the soft parts succeed each other, step by step, till the limb, if it be not well attended to, falls into irrecoverable disease. This state of a wound cannot require poultices, fomentations, leeches, and a low regimen; it proceeds from relaxation, and requires quite an opposite practice. The patient, after the loss of blood, the pain and disorder proceeding from a great wound, has lain continually in bed, and during fifteen or twenty days has enjoyed no rest, has lost his appetite, has wasted in strength, and declined in health. He has now a degree of fever, a diarrhœa, a furred tongue, a low and weak pulse; and as for the limb itself, it is turgid and swelled from the trunk of the body downwards; it retains the impression of the finger like a dropsical limb; it is spongy and colourless every where but at the wound; and even the wound itself, which is supposed to be inflamed, has nothing of a lively inflammation, but, on the contrary, is dusky and livid, with flabby lips, and a foul and gleety discharge. These are marks of nothing but relaxation, such as will be perpetuated, if the same ways of treatment be continued. In one sense, indeed, I agree with those who think that a poultice will promote suppuration, or force it; for I think that fomentations, poultices, greasy applications, a total want of support, and the filth of its own matter accumulated about it, will keep a suppurating wound for ever in a state of suppuration. Yet these errors are now so common, that they are regarded rather as the regular routine of practice; and a surgeon is not blamed who, visiting such a leg every day, sees it swelling more and more, and growing daily worse and worse, orders it to be wrapped up again in its poultice; and ascribes the swelling, and profusion of matter, merely to the inevitable consequences of the wound.

I must truly confess, that while we are improved in all the great and difficult points of surgery; we are gone backwards in all the nice and delicate attentions, which are so necessary in the cure of wounds. When barbers affected the character of surgeons, surgeons were forced to imitate their methods of careful niceness in dressing, and became their rivals even in their own peculiar trade of dressing sores; but it seems as if now that surgery has risen to its proper rank, surgeons were even at pains to depart as far as possible from the frippery of this manner, by which many useful methods have been lost, and the practice of common surgery become slovenly to a shameful degree. Long ago a surgeon could never do too much in the way of probing and searching wounds, tenting them to the quick, injecting them with balsams, and torturing the limb with injudicious bandages; but now a surgeon thinks he has done enough in clapping a plaster over a sore with the palm of his hand, or with clean hands he feels the pulse for form's sake, and orders the limb, without regard to its condition, to be laid in a mash of poultice.

This relaxing poultice, which is so easily prescribed, and so indiscriminately used, is good only in the first days of a highly inflamed wound, where there can be no hope of curing by adhesion: it is to be used in all wounds where, having tried to procure adhesion, we find that it will not succeed; where the stitches are bursting, the wound inflamed, the lips swelling, and the parts ready to fall into suppuration; where, in plain terms, our alternative is suppuration or gangrene! where forcing and straining the wound with stitches and bandage would produce gangrene; where we are glad, through necessity, not choice, to throw it loose, and wrap it in a poultice, in order to procure suppuration.—In a part so lacerated by a bite, by machinery, by falls, that it cannot adhere, or, at least, must be established in suppuration before it can adhere, poultice is needful.—It is proper also in those great wounds, where men being buried in mines, the flaps of skin which are torn down are choked and mixed, as it were, with coal-slack, or earth; or where a man having fallen among sand, or rough stones, the flaps which are torn down from the scalp or other part, are filled with earth or mud: in all such cases poultice should be first applied; and when the parts are thoroughly cleansed by suppuration, the flaps may be replaced, and retained.—When a limb has been battered by shot, or machinery, or the fall of buildings or mines, so that the bones are broken, the joints crushed, the limb irrecoverably destroyed, if the surgeon has come too late to perform amputation, if he is fearful of gangrene, and is waiting for suppuration, there is no better application than fomentations or poultice.—In the first stage of gunshot wounds, especially where bones are broken, fomentations or poultices may be used; but when the sloughing is over, and the limb falls into a relaxed condition, we change our plan of cure.—Even in the case of common abscess, though we know of no application so soft and pleasant, so effectual in relaxing the skin, and promoting a suppuration, as poultice, yet the suppuration being perfect, and the abscess burst, the continuing this poultice (as is but too often done) relaxes the parts, and increases the suppuration. Even in this case, the fairest of all for using of poultice, we use it but for a time, and for a purpose.

But when we come to a neglected limb, lying in a slush of matter and foul poultice, we plainly perceive, that this lax swelling, this profusion of matter, and even the attending diarrhœa, nausea, and fever, which surgeons complain of, proceed sometimes from their own negligence and ill practice. This relaxing poultice is suffered to be renewed daily, or to lie without being renewed! under the pretext of the wound being a suppurating one; a fomentation perhaps is ordered, with hopes of stimulating the flabby parts to some degree of action, but so carelessly is this fomentation applied, that the joint or the limb receives more cold than warmth, and the bed is soaked with it! for half an hour of warmth and comfort, the patient suffers permanent cold, filth, and moisture: and how much harm is done in hospitals by these two applications, it is impossible to express. This condition of the patient is itself a great part of the disease; under this careless treatment the limb grows every day more and more turgid, the suppuration continues to increase, the flesh becomes pale, the wound flabby, livid, and indisposed to heal; the alteration which a sensible change of practice brings about upon a limb so neglected, is very sudden and pleasing.

We remove the poultice, and lay a piece of dry lint into the wound; we use a stimulant fomentation, made of a strong decoction of camomile flowers, with sal-ammoniac and spirits, to cleanse and excite the skin; we dry the limb thoroughly, and roll it; we dress the wound the next day with slips of plaster, that the dressings may come easily off, and with soft and fine lint fill up the basin of the sore, laying a flat sponge above the lint to absorb the matter of the wound. The patient, in place of soaking his limb with a fomentation or poultice, rubs in with his own hand some ointment or balsam suited to the condition of the wound. If at certain dependent points, or if round a joint, suppuration is threatened, let him rub in a soft ointment of marsh-mallows, or palm oil; if he is tortured with pain, let him rub the part with laudanum and camphor; if the parts are to be stimulated to a more healthy action, let him rub and stroke the limb with his own warm hand, using camphorated oil, spirits, and soap, anodyne balsam, or any stimulant embrocation; let the lips of the wound be supported with soft pledgets of lint, and the whole limb be rolled carefully from the toes upwards: by which the general swelling of the limb will be dissipated, and the healthful action supported, the tumor will be repressed, except at the place of the wound itself, the wound will look florid and healthy, and the patient will be easy, his sleep will return, his diarrhœa will stop, and his appetite will be restored.

But if, to the ill condition of some great wound, there be added a general injury of a limb, the case becomes very complicated and difficult, compared with this mere relaxation of the limb, or bad condition of any single wound; for when the wound is deep, and the opening narrow, the bones broken, or the flesh bruised against the bones, there are various internal parts hurt which successively fall into disease, with great disorder of the whole member. Then the limb swells, with great danger of gangrene, if it escape the present danger (which is over in a few days), then irregular suppurations ensue, successive abscesses form; the skin swelled up by matter, and, insulated from the parts below, bursts, wastes with suppuration, is perforated with many openings, and at last sloughs and is entirely destroyed. The cellular substance, which connects the muscles with the skin and with each other, is the chief seat of suppuration; and the cellular substance being diseased, the muscular flesh of course suffers, falls into suppuration, wastes during the inflammation, and the abscess is cured only after great loss of substance, and such a knotting together of what remains of the macerated flesh and diseased skin, that the use of the limb is lost; it remains lame, disfigured, shrunk and rigid.

If the suppuration surround a joint, there the matter cannot penetrate deep, for the capsule, fasciæ, and all the less sensible membranes which surround a joint, resist the suppuration, but the matter works round the joint, with great pain, misery, and hectic fever; the skin is thickened and puffed up, is perforated by the matter; the whole ball of the joint, as of the shoulder or knee, is massed by inflammation into one confused knot of thickened skin and ligament, while deep abscesses and fistulous openings surround the joint in every direction. If the life be saved in such a case without amputation, at least the use of the joint itself will be lost.

But if the inflammation go still deeper, and the matter work itself downwards among the muscles, and especially if some broken pieces of bone lead the suppuration inwards, the bones themselves are inflamed, carious pieces of bone are thrown out from time to time, with successive suppurations, and great pain, and the limb becomes thoroughly diseased to the very centre. To the disgrace of our profession, books are full of nothing but bloody operations; yet, what merit is there in performing trepan or amputation, compared with that of curing such a limb?

In the first stage, and while abscess is forming in the limb, you will watch it with incessant care; for an abscess which might be easily cured, often, by being neglected, goes down to the bone. At each dressing you feel carefully all parts of the limb; you allow no complaint of pain, no appearance of redness, no feeling of softness, to pass unobserved. In a disease like this, an abscess does not project from the surface like a boil, but works downwards among the interstices of the muscles, long before the part becomes red. This is an abscess forming in the midst of a great mass of thickening and disease; the abscess is often the flattest part of the limb; and when you feel one part sinking below the level, and the integuments becoming thin; when your fingers sink into a softish hollow, which feels empty, with a hard and knotty border surrounding it, you may be assured the abscess is formed. Then you must open it, lest the matter sink deeper among the parts; you never make a large opening, nor cut up the skin, but use, in place of the broad-shouldered abscess lancet, a small bleeding lancet. Strike deep; open the abscess thoroughly, but with an opening so small, that you need to press out the matter diligently every day. You will soon discover whether your opening be central, and whether the exit be free; you introduce your probe, and feel whether there be any undermining of the neighbouring parts, any obliquity of the abscess, or whether the abscess be of such extent that a counter opening is required; you squeeze out the matter gently, but with perseverance; and having emptied the abscess, you take advantage of its sides being put together, and endeavour to reunite them; you fit your compress to the shape of the hollow, you make it of soft rolled lint, sometimes you lay on the lint in handfuls; you roll the part carefully, and with such a degree of firmness, as keeps the sides of the abscess in contact: though you may not procure adhesion at the first, you reduce the size of the cavity, lessen the quantity of matter in a remarkable degree, and in the course of time, you find the parts grow firm, and the sides of the cavity adhere.

By this prudent and careful proceeding, you gain every object; you save the skin from being further destroyed, and the parts within from being further drawn into disease: but if you neglect this opening, the muscles, or even the bones, suffer; if you open it, and then neglect it, the openings grow fistulous, and new abscesses are formed. By opening the wrist joint, in a case of gunshot wound, with a small bleeding lancet, in three points, with these precautions, I have saved the joint; whereas the slightest incisions, in the same wards of the hospital where this man lay, burst out into frightful sores. The older surgeons well knew the art of managing suppurations by a bandage, an art too little studied, or rather too little cared for by the modern surgeon; but they were careful to accommodate their compresses to the form of the abscess, and to alter their place as the matter changed its situation. When they rolled their bandage in such a manner as to prevent matter sinking into some hollow, where it might work downwards among loose cellular substance, they called their bandage FASCIA APOSTHEMA PROHIBENS; when they pushed the matter before the compress, towards some point which they judged safe, they called their bandage FASCIA APOSTHEMA FACIENS; and they called it FASCIA UNIENS when they obliterated a cavity, by procuring adhesion of its opposite sides. It is not in order to inculcate the same practices that I enumerate these old names, but to remind you of some of the various uses which the older surgeons made of rollers, and which you will do well to imitate, especially in promoting the obliteration of cavities, and the reunion of parts, and in supporting those places which are threatened with abscess.

You must learn to vary your practice according to the nature of the case, and especially according to the parts concerned. If the suppuration be on the outside of the fascia, or strong binding membrane of the arm or thigh, then your chief business will be to observe the rapidity with which the matter will undermine the skin; for the fascia, like the membranes of a joint, excludes the inflammation, and resists it; the skin only is inflamed, its cellular substance is destroyed; the skin, by being thus separated from the fascia beneath, is so far deprived of its nourishing vessels, that it is hardly alive; it is thin, livid, ready to burst, and the least accident will make it slough, and fall off in gangrene. The matter always following the direction of the muscles, falls from above downwards; if the inflammation be near the haunch, the abscess, undermining the skin of the thigh, bursts at the knee; if in the leg, the matter follows the muscles to the ancle; if in the fore-arm, it bursts out at the wrist; and some degree of management is necessary to give a free vent for the matter, so as to preserve the skin.

In gunshot wounds, or in the bruises of great splinters in battles at sea, you will most particularly observe this course of the matter from above downwards. It is from this working of the matter to distant parts that the surgeon, after long searching, is often disappointed of finding the ball, and feels for it at the point most distant from its real place. If, for example, a man is shot with a musket ball in the haunch, the whole thigh will swell, the integuments will be separated from the thigh, the muscles too (especially if the wound be deep), will be, as it were, dissected by the matter; the chief abscesses will burst near the knee, the surgeon will search there in vain for the foreign body; the patient will be exhausted by pain and hectic fever, and when he dies the ball will be found lying flattened against the haunch bone, or sticking about the trochanters of the thigh bone: Or a ball passing clean through the fore-arm, the abscesses, which begin to form about the elbow, will extend down to the wrist; or the elbow being only bruised and slightly wounded with a splinter, the abscess which forms will cover the whole of the bellies of the extensor muscles, and burst at last near the hand.

Here, then, you may easily perceive, that it is not the foreign body lodged in the wound, nor the bruising of the parts, but it is the matter itself following the tract of the muscles that causes this extensive disease. Here it is really in your power to hinder the progress of the matter in some degree, and the roller and soft spongy compress which you apply to support the skin will be truly a fascia aposthema prohibens. You must be careful chiefly of these things; first, To open the abscess early, knowing what destruction the confined matter will make, if left soaking its way downwards through the cellular substance of the skin: Secondly, If you find that it has already made great progress, and that the abscess points below, you must introduce your long probe, pass it down to the very lowest point, and cut it out, so as to make a counter opening, by which the abscess will have from all parts a free discharge: Thirdly, The skin being thus weakened, being already highly inflamed, unsupported by vessels on its lower surface, its cellular substance being entirely destroyed by the suppuration, there is great danger lest it slough, with a total loss and destruction of the integuments of the fore-arm, for example: injections, even of the most simple kind, are in these circumstances so dangerous, that if unfortunately a stimulant injection be thrown in under such an extensive surface of diseased skin, it will gangrene and slough; or if, under pretence of evacuating the matter freely, this inflamed skin be imprudently cut up with a bistoury, the skin must inflame to the very highest point, beyond what it can bear; and being unsupported by its natural vessels, it will die and slough off. For these reasons, then, you never are to use the knife; you are only to make fair counter openings; when you push through your probe, you may draw after it a fine and small seton; but even a small seton is too irritating, and you are to continue it only a few days till the opening be thoroughly established; whenever you are sensible that the course of the matter is free, you must try to lessen the cavity, and to keep this great surface of skin in contact with the parts below by a gentle roller; but the bandage must be rolled very gently and very equally, and your compression must be made, not so much with firm bolsters, as with a handful of plucked lint laid over the whole*; you thus press down the skin that is already injured, so as to make it reunite, and you oppose a barrier to the further progress of the suppuration.

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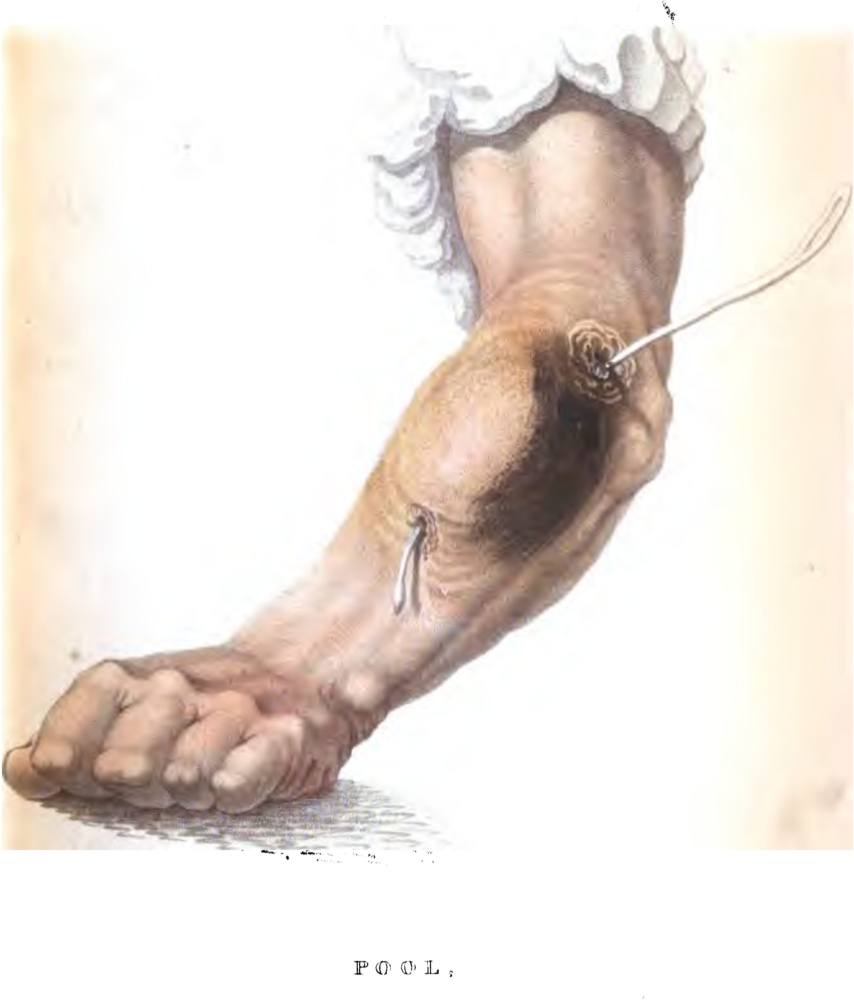
* The two drawings of abscess in the fore-arm illustrate what I have explained in these remarks. The drawing of the arm of Captain Joannes Marinus Pool, captain of the Wassinaer, shows how abscess works along under the skin from the elbow to the wrist. He was supposed to have been shot by a ball, but I am persuaded this was not the case; the wound was made merely by a splinter; the hole was ragged, and was nothing like that of a ball; the wound was so immediately over the bone, that a ball passing here must have broken the condyle of the shoulder bone, and either gone through the elbow joint, or have been felt lying upon the bone. His arm inflamed, and by the tenth day after the battle, the whole skin of the fore-arm was undermined, and ready to slough. I made that opening through which the probe is pushed, just in time to save the skin, and to prevent the abscess reaching the wrist; a seton was drawn through it for three or four days, which brought the parts into so good a condition that it was then withdrawn.



POOL;

CAPTAIN OF THE WASSINAER.

wn by J. Bell. *Engraved by J. Stewart.*

London. Published 1826. by Thomas Tegg. 73. Cheapside.

If the inflammation, in place of merely undermining the skin, go deep among the muscles, then the

The lower opening was preserved, and the skin laid flat, and reunited with compress and bandage.

The other drawing, viz. that of the arm of Charles Challoner, a marine, shows how a ball, passing clear through the arm, produces very nearly the same form of abscess with a more superficial wound. This man was working a carronade upon the forecastle, and was among the first wounded in the ship. He was not sensible of being wounded, but observing something drop from him, he stooped to pick it up, and found it was a musket ball. He put it in his waistcoat pocket, and continued working his gun. After his gun had been twice fired or so, one of his comrades called to him that he must be wounded, for that blood was trickling from his wrist. He answered at first, that it could be nothing but the squeezing of his fingers under the breech of the gun, but upon looking to his sleeve he saw blood spouting out from a wound near the bend of the arm. Then his comrades made him go down to the surgeon, where, upon turning off his jacket, he found that the ball had passed through his fore-arm. A piece of lint was put upon it, and he laid himself down in the cable-tier, where he was soon after wounded a second time with splinters in the other arm.

The ball must have entered while he was pulling a rope; it entered at the hole which is seen on the fore part of the arm; it passed under the bellies of the supinator muscles, through betwixt the radius and ulna, and passed out at the elbow through the belly of the anconeus muscle. Had such a wound healed easily, and without much swelling of the arm, it should have been let alone, and nothing done but a cold lotion put on the whole arm; but when it inflamed and swelled up, a free exit for the matter should have been provided; but the opening was narrow, the ball had passed through the thick of the arm, inflammation and suppuration came on, the wounds were so close that the matter was confined; and he endured great torture while the matter wrought its way downwards. The arm was monstrously swelled; the abscess which is represented in the lower part of the arm began to form on the fifteenth day of the wound; it burst through the skin and fascia on the twenty-sixth day of the wound, and the moment that the matter burst out he was relieved from great agony. The lesson which results from this case is very strongly impressed from what the lad suffered. The abscess in such a case should be watched carefully, and opened early, and not allowed to destroy the fore-arm for a month nearly; for though it may be a very good rule in the affair of a common boil, or superficial abscess, to say, "We will wait till it be ripe;" yet in a case where the internal parts are in danger, as soon as we discover the abscess it should be opened; and if the probe passes downwards to any extent, a counter opening in some other dependent point should be also made to prevent a second abscess, and a new bursting of the skin. In this case, by neglect-matter finds new cavities and hollows to lodge in—makes new and crooked passages for itself from point to point—one abscess forms after another—the suppurations become very irregular and extensive—and this is what surgeons incorrectly call a fistulous sore. It is not so; for while the parts continue inflamed, and the suppuration good, the disease, however extensive, is merely an irregular abscess; and what is chiefly required is some means of diminishing the number of irregular suppurations, and as it were concentrating the disease; for the surgeon seeing matter confined, the openings narrow and irregular, and new abscesses forming from day to day, is uncertain which way the matter tends. He knows that it is destroying the muscles, and fears that it may be spoiling the bones; therefore he chooses from among the number of openings those two which seem most convenient for his purpose, and introduces a seton from the one to the other; or, from one opening, he pushes down his long steel probe to the bottom of some recent suppuration, cuts out the probe, and so draws a seton through the most centrical part of the suppurations. This seton is not to be removed when the new opening is established; it is to serve a more important purpose; it is to lead the pus to those particular openings which the surgeon has chosen; it is to prevent the matter working deep among the muscles, and draw into this single channel the matter of all the collateral abscesses. The seton concentrates, as I may express it, the inflammation and suppuration, and brings the disease into one direct line, so that we know where to apply

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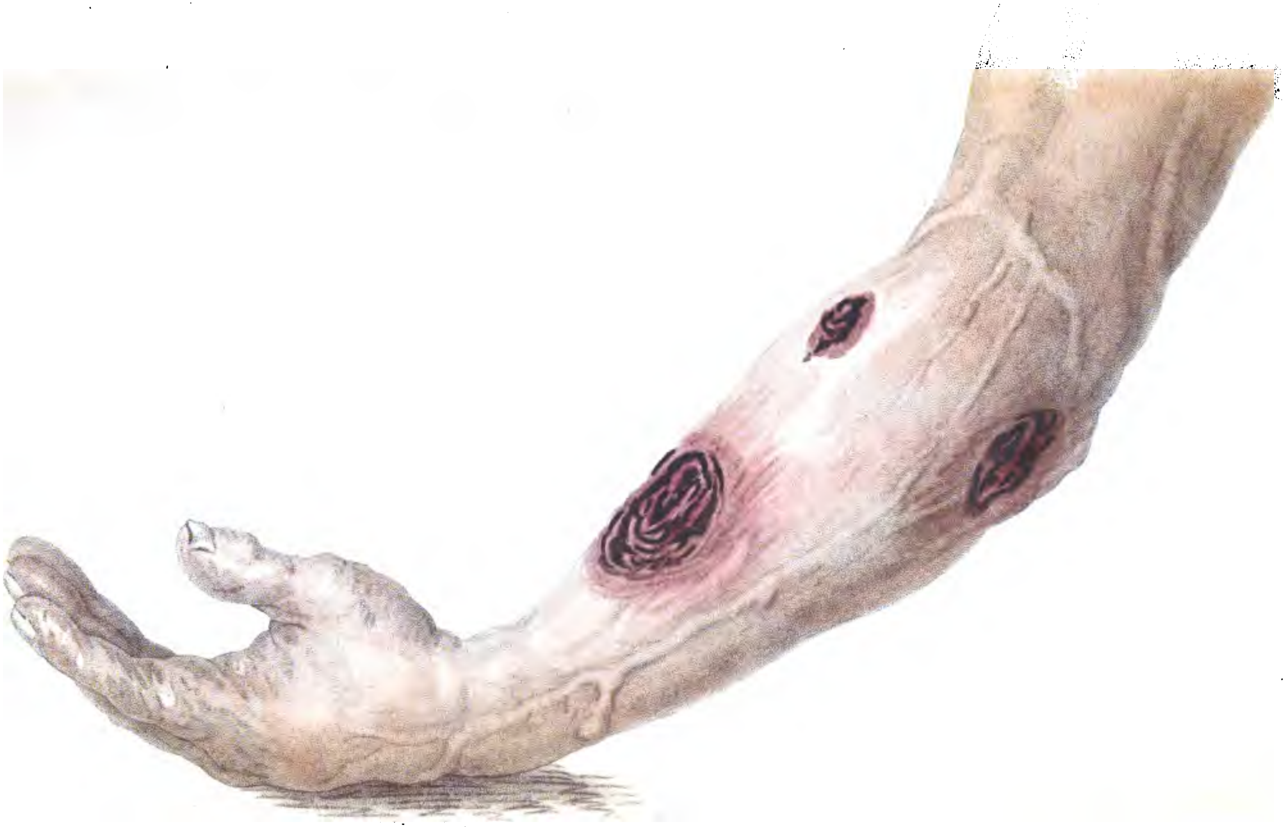
ing a counter opening, the lower suppuration broke out into a very ugly, unmanageable, and extensive sore; and the lad being thrown into a very foul hospital-ship, there appeared to me little chance of his being cured; yet he did recover after a long while, and with much wasting of the arm.

ARM OF CHARLES CHALLONER, MARINE.



rawn by J. Bell.

Engraved by J. Stewart.

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our compress and roller; we so narrow the passages, and lessen the quantity of matter, and empty the collateral abscesses, by the operation of this seton, compression, &c. that in the end the seton may be withdrawn. This seton must be continued during the whole cure; but in such cases injections are never to be used; for this is not a true fistula, but an irregular abscess; the parts, though extensively diseased, are in a natural state of suppuration; the cellular substance is open to an injection: an injection rashly thrown into such an abscess will not be confined to the disease, but pass under parts that are sound: the cellular substance being imprudently injected with any stimulant tincture, the whole limb will swell up, and the swelling and new inflammation will be resolved only by the formation of new abscesses, and more extensive suppurations*.

This is indeed the kind of abscess which often ends in a fistulous sore, but yet it is not one. More commonly a fistula proceeds from some foreign body lodged deep—a ball, a piece of iron, a rag of cloth, or a spoiled bone, which prevents the healing of the wound; and the circumstances and peculiarities of a fistula are very easily and naturally deduced from this cause: for where foreign bodies are lodged in the part, and, of course, when foul matter is allowed to stagnate, the part where the ball is immediately lodged cannot easily heal; but the passages where this foreign body is not immediately lodged recover almost their natural condition, and the only inflammation is at the bottom of the wound, where the foreign body lies irritating and supporting the flux of matter, which must find its way out. Such a wound endeavours to heal, but cannot heal; the pain and great suppurations have subsided; even the general lax swelling of the limb is much abated; or if pain and inflammation come on from time to time, it is when the openings contract, close upon the matter, and threaten to heal; the orifices are small, the passages irregular, narrow, deep, and crooked; the matter thin, ichorous, bloody, sometimes black from the spoiling of a carious bone; the walls are tube-like, firm, and callous, and so condensed, that an injection thrown into a true fistula cannot, as in an irregular abscess, go abroad into the sound cellular substance.

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* It was just this fistulous sore, with various openings, that the ancients called Reduplicatio Vulnerum. They plugged up the wound with firm tents, and confined the matter; the matter wrought backwards, forming various passages; upon introducing their probes, they found them enter, first one passage, then another; and seeing but one opening, and two or more internal passages, they thought the wound was doubled. They said it came about, Propter tremulentiam manus quæ vulnus infligit, aut propter motionem agitationemque corporis vulnerati. They often managed their tents and injections so ill, as to have more than a mere reduplicatio vulneris. They had two or three irregular passages, not so easily accounted for by the trembling of the hand.

Here our business is rather to excite inflammation, and provoke the sensibility of the parts. We use setons and injections in this case, with a very different and much bolder design. Setons are used rough and large, that they may irritate. They are used to force the parts into a state of suppuration, and to destroy the callosity; and while they stimulate the callous tube, they make a free passage for pieces of iron, rags of cloth, or carious bones. We also inject a fistula sometimes with barley water, merely to cleanse the fistula, but oftener with tincture of myrrh, along with bark decoctions, to correct a putrid ichor, especially when there are corrupted bones in the fistula, or where blood has been extravasated through the cellular substance, which produces always very foul and fœtid suppuration. Sometimes we are really under the necessity of using escharotics, as injections of ærugo with oil, or strong stimulants, as turpentine diluted into the form of a balsam, with oil, basilicon ointment, or balsamum arcæi; yet for a slightly stimulant, and cleaning injection, perhaps there is not a better than rough red wine.

Even small incisions are allowed here. We lay open any smaller fistula, in order to get a more direct passage for our seton or injection into the greater fistula, or to enable us to cure and heal up some collateral fistula. We also use sometimes a sponge tent, or piece of gentian, to dilate some particular opening, or to make way for confined matter; and when, by care, and various inventions and practices, we have obliterated the collateral fistulæ, made good counter openings, procured a free vent for the matter, and brought the whole disease into one direct line; when, lastly, we have brought the tube or inward surface of the great fistula into the state of an inflamed, active, and granulated sore, and have converted the thin ichor into a well-conditioned pus, we endeavour, with our rollers and compresses, to reunite the parts, forming, by the manner of rolling, what the old surgeons called their Uniting and Expulsive Bandage. When these abscesses become chronic, and degenerate into a kind of spurious fistula, rest is as necessary as compression. Now every body thinks he knows what is meant by rest, when in fact very few do. It often happens, that the insensible play of a muscle or its tendon, by inducing a continual slight degree of friction in the sides of an abscess, is keeping up the discharge. Thus a wound on the back does not heal, because the patient moves his arm; and the motion of the arm is attended with a motion of the latissimus dorsi. Or a sinus has long existed on the fore part of the chest, from the motion of the pectoral muscle. To keep the diseased part at rest we must bind up the arm*: so must we bind the jaws when there is suppuration in the temples: so must we secure the foot, and stop all motion of the ancle joint, if we have to cure a fistulous wound among the muscles of the leg. This is a principle of the utmost consequence; as an intelligent eye may discover in going round an hospital.

Wounds with collections of matter round a joint are the most afflicting of any: the matter is resisted by the capsule, and makes its way round the joint, among the loose cellular substance; it finds out the weak parts, as the axilla or ham, and works towards them, and often it draws the acromion process of the scapula, or the olecranon of the ulna, or any other projecting bone, into disease. The joint then becomes stiffened and deformed, the integuments swell round it; in some parts abscess forms, in others the skin is wonderfully thickened; there is all the appearance of white swelling, but the cavity of the joint itself is not affected, though at last, if neglected, the disease penetrates into the cavity, and the true white swelling, or disease of the joint, is produced. When the shoulder or knee are thus massed by inflammation, hardened, as it were, into a cartilaginous knot, and perforated at all points with fistulous sores, the ligaments of the joint are thickened, its motions are lost, and even the partial cure, by a stiff joint, or Anchylosis, is hardly to be obtained. The agonizing pain and want of rest, the diarrhœa and hectic fever, which are inseparable from this degree of irritation, often destroy the patient, or hurry us on to amputation. But while the diarrhœa and pain can be moderated, while the strength lasts, you should try to cure the disease, by varying those practices which I have just mentioned. You should be careful not to relax the parts, nor hurt the little vigour that is left in them; you should remember that the skin covering such a joint is much insulated, and tends greatly to inflame, and therefore you should be cautious in using injections. You should be the more anxious and prudent, because the joint itself may be affected, and you may be driving a very irritating injection into the cavity of a diseased joint; nevertheless, cleansing, or even stimulant injections, barley water, diluted tinctures, or wine, I do not condemn. You should be careful to watch abscesses, and prevent their extension by openings with the lancet; perhaps it may be right to use a seton, in order to procure a free drain of matter. You may occasionally enlarge one fistulous hole, in order to heal up two or three collateral holes depending on it. You should use a poultice only after an incision, when the parts are irritated, and must be appeased; a fomentation you will use often, but you should make it hot and stimulant, and continue it but for a short while; you should support the joint with compresses, or rather cushions of lint, and a roller; but be fearful of tents, which both irritate the parts and confine the matter; rather enlarge the fistulas with the knife. If by a shot, or other wound, the bone be crushed, you easily discover it at first, but not perhaps the whole extent of the injury. If in a scrophulous body, the acromion, or the sternum, or any other bone, be spoiled by suppuration, you know it by the black and peculiarly fœtid discharge; you feel it with the probe through the many fistulous openings which run along the ridge of the bone. A man of experience learns even to know by the eye this state of the sore; and if there be such a diseased bone, added to the other disorders, and if the bone be projecting at one end, you shake it from day to day till you get it out. Or if diseased integuments cover the carious bone, having fistulous holes from point to point, you take the bistoury, and lay the openings all into one, and take away the diseased bone.

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* The following case, which I have extracted, is an instance of an ignorant man blundering upon the cure of a fistula in the breast, which would have done him honour, if either he had intended what he did, or had understood what he had done.

" A. B. a gentleman of sixty years of age, valetudinary in his constitution, subject to pulmonary complaints, was, at the approach of a very severe winter, attacked with a feverish indisposition, which terminated in an abscess in the axilla. It was slow and indolent in its progress, but at length it maturated, and was opened freely by the knife. It continued to discharge for several months, sinuses being continually formed, all of which were opened. The wound contracted finally to a small aperture, leading into a sinus, which extended far up under the pectoral muscle. The operation of opening or counter opening was in this case impracticable. Irritating tents, the sublimate troches, and injections of various kinds, were used to produce a coalescence of the fistula, but all proved ineffectual. At length he had determined to content himself with his misfortune; but going out of town, he was overturned in a carriage, and suffered a compound fracture of the arm. He was then necessarily confined to his bed, and the arm kept in a perfect state of quietude. At the end of six weeks he recovered from his fracture, and at the same time had the satisfaction of finding the fistulous sore in the axilla completely united."

And, after all, then, none of these cruel tents and injections were needed; nothing, indeed, but a bandage to bind down the arm, and compress the fistula. This case shows us, that unless a man have a clear intention he can do no good in surgery. This surgeon had made the insides of the tube raw and sore by his injections and tents; he had only forgotten to put the sides of the fistula together, and to stop the gliding motion of the muscles.

But sometimes those suppurations, though they do not absolutely enter into the joint, draw the

Bursæ Mucosæ into disease, which are, as it were, a part of the joint, of the same structure indeed with the capsule itself. This is a serious addition to the difficulties of the case; the great bursæ of the wrist and ancle are, in plain terms, the sheaths of the tendons; those sheaths are particularly close; they enlarge as they approach the wrist and ancle, and are bedewed with a very plentiful secretion: even in their healthy state this secretion of the bursæ is in great quantity, but when the bursæ are inflamed, it is astonishingly profuse.

“A young man of the name of Heartry, a marine on board the Ardent, was wounded with a long shaft-like splinter of wood, which stuck like an arrow upright in his leg, and was pulled out apparently entire. I had no reason to believe that any foreign body remained in the wound. This shaft had pierced the gastrocnæmii muscles, or rather, I think, betwixt the gastrocnæmius and soleus, near where the tendon begins. Here was a part certainly destined to inflame; even had the wound been made by a ball passing clean through this part, it must (like the shot which passed through Challoner's arm) have produced inflammation, swelling, and suppuration, among the muscles, and this should have been foreseen and provided for. The wound, which was a stab with a very rude point (a kind of wound which never fails to suppurate), should have been very freely dilated; for as it was not properly a gunshot wound, there was no sloughing to be expected, such as might open the wound; the very inflammation which was forming matter within choked the wound without, and prevented the discharge. The suppuration went on inwardly; the leg swelled to an enormous degree; the original wound, thus closed by inflammation, was so callous, moreover, and so nearly healed, that when this lad came first under Mr. Kiernan's care it was difficult to introduce a common probe, but when he did get the long steel probe introduced, it passed down nearly to the ancle joint. Mr. Kiernan dilated this upper opening just as he would have done a gunshot wound, and put into it a syndon (or small slip of linen) to prevent its reunion, hoping, by compresses and an expulsive bandage, to prevent the matter getting lower. But unhappily for this poor fellow, and many others, Mr. Kiernan was called away to another department. The matter had now worked its way so low down, that a counter opening should have been made; but this was neglected; his roller was awkwardly and carelessly applied, without any decided intention, and the matter continued to work downwards along the Achilles tendon. When I was first called aside in the ward to see this leg, I do not think there could be less than three pounds of matter collected, reaching from the narrow tented wound in the calf of the leg to the heel, the whole leg swelled to a monstrous size, the poor creature greatly wasted with pain and hectic. I put down the long steel probe, which passed from the small wound above the middle of the leg to the hard skin near the heel; and having cut upon the point of the probe, the matter jetted out, and continued to run in a full stream. It was plain that the bursæ which accompany the Tibialis Posticus formed a great part of the disease, but the nature of the disease was very clearly marked by the mixed appearance of the discharge; for before this counter opening, the matter being always pushed upwards, it was observed that the matter which first came up through the narrow orifice was a foul and bloody suppuration (plainly coming from an abscess of the common cellular substance under the gastrocnæmii muscles); but what came next was a thin, glutinous fluid, which was manifestly pushed up from behind the inner ancle, and plainly indicated a disease of the bursæ mucosæ: from the time of putting in the seton, there was discharged at each dressing (that is, morning and evening) full two pounds of this thin and mixed suppuration—it ran out like urine from the wound, horribly fœtid. Now you will observe, that from a very slight wound this young man lost his health; he was, at the time of my writing his case, reduced to extreme weakness; he lay quite melancholy and despairing;—indeed, should he live his leg will certainly be destroyed: had he been strong enough to bear such an operation it would have been a charity to have cut it off. You see then the dangerous effects of allowing the disease to work its way to these bursæ; and now, in a second instance, you perceive the sad consequences of not dilating the first wound, of not watching the inflammation, of not hindering the descent of the matter, of not making an early counter opening at the lowest point; and where there is, as in this instance, a deep swelling, inflammation, and suppuration, with a string of tendons, and a set of bursæ, leading the disease towards a joint, the abscess should be watched with particular care."

But to return to the point of diseased bones: it is a complication of the disorder peculiarly frequent in gunshot wounds; and I have one piece of advice to give you, which, if I may guess from the ill consequences of neglecting it, will be of some use. I advise you to take away diseased bones the moment they can be disengaged; for a diseased bone is as a foreign body, which continues the disease, supports the inflammation of the soft parts, and hinders the continuity of vessels, and the generation of callus within. It is, I acknowledge, against all rules of good sense and discretion to be inexorable in picking away or cutting out every little piece of bone which seems disengaged at the time of receiving a wound; for at first no man can decide what parts of a bone are disconnected or irrecoverably destroyed; but where a bone has been fractured by a musket ball, (which never fails to destroy the organization of the bone), where, in the course of a long suppuration, a bone becomes loose, or where a bone has gradually become carious, and we have observed the disease through all its progress, or where a bone, which at the time of receiving the wound did not seem loose, is in the end disengaged by suppuration, the condition of such bone is very unequivocal, and it is equally plain what we ought to do. The sooner such a piece of bone comes away the better: I say comes away, for I would have you to leave this business in some degree to nature: I would have you prudent, but not negligent: I would have you wait till the bone be in some degree loosened by the natural process, but not till it be expelled. Such a carious bone is effectually a foreign body; neither can the integuments recover, nor can callus form, while it remains. While it remains, the sinous ulcer continues without hopes of a cure, a putrid ichor is discharged, and the patient continues to be exhausted with the disease. I know no one good effect of delay; I know no reason why the bone should not be pulled away; it is loose, nature has disengaged it, and perhaps can do no more; if after it is loose you will leave it there, you may leave it for an indefinite time, and the patient will pay the price of your timidity and carelessness. I have seen surgeons who, had it been a ball which had kept the wound open, would have been in great haste to get it out, and would not have been over scrupulous about the means; but a dead and dry bone, worse than a ball, within their reach too, they will not touch, saying, it is to be left to nature, because nature discharges diseased bones! There is no doubt that nature will free herself, in the end, of any diseased bone; but that is no reason why nature should not be assisted; if this were really a reason, it would strike deep against many of the most useful parts of surgery. I have seen a bone sticking for six months, like a truncheon, out of a wound, which one smart twitch with the finger and thumb, or a shake now and then, would have disengaged, even while the patient was asleep. Therefore I give you this advice, to disengage diseased bones as early as you can, without absolute violence; the worst that can happen is, that, by shaking the bone too freely you give a little pain, or bring a little blood, which is over in a moment. Even when there is a necrosis, or, in other terms, a new bone generating to replace that which is spoiled, where there is a process going on very interesting, and which we are unwilling to disturb, we do not spare even this new shell of bone, but split or cut it up to get out the old one, which protracts the cure; if we do this in cases of necrosis, much more should we cut up the integuments, and pull out a bone which is simply carious!

NOTE ON TAKING AWAY THE BONES WHEN SHATTERED BY GUNSHOT.

THIS part of the subject requires some comment. The condition of the limb, and the state of the bone, are here truly described; and the very conclusion is pointed to, but the rule is not given in a manner sufficiently decided. A bad compound fracture, when there is an open wound and broken bones, is very similar in its consequences to a gunshot fracture, and the same difficulties, and the same questions, at the same stages occur. The swelling becomes general; deep and large abscesses form in the limb; the shattered bones are surrounded with matter, and the centre of the limb is a large irregular abscess. We put in the finger into the wound, and we feel everywhere sharp jagged bones, which are dead, and which have become a source of unusual irritation.

This condition of the limb is to be foreseen by an intelligent surgeon immediately after the accident. He introduces his fingers, he removes the portions of bone which are loose. Certain portions are still attached, though loose. Are they also to be removed in a violent manner? No. But the wound is to be enlarged, and this is the reason of the incision. When the suppurative process comes on the limb, if the matter have an easy exit, the process goes on with comparative ease; but if any thing of the nature of an abscess be permitted to form in the centre of the limb, then the bones (which have been broken off but not detached from the periosteum) die, they become a source of additional irritation and mischief. Another unhappy consequence results from the confinement of the matter; instead of having its course outward, it works into the very centre of the shaft of bone which is broken, and the end of which is in the abscess. The consequence of this is the death of that bone, and the formation of what is called necrosis. When this disease forms, the patient is confined for years, after having passed through the first perils of his case. All this is avoided by an incision, which allows you to pick away the bones which are actually loose, and to afford free exit to the pus when suppuration takes place*.

OF ULCERS.

And now I am more particularly to direct your attention to Ulcers.

Have you reflected on the distinction betwixt an ulcer or sore, and a wound? In common language no proper distinction is made, yet it is to us very necessary. An ulcer is that surface which has no cuticle, and discharges a fluid different from the natural secretions of the skin. It may be formed without external injury, or a wound may degenerate into this condition, and when the wound is kept open and discharging from some source of irritation in it, from some local cause of weakness, or from some vice of constitution, it may be very properly called an ulcer; and it is in this way that what was a wound last week is now become an ulcer, and depends on a condition of the constitution.

When in place of a deep and bruised wound you have a flat and superficial wound, it often degenerates into a sore; and the methods by which the cure of such sore or ulcer is attempted are very universally known. Occasionally, a sore may be wrapped up in a poultice, or soaked in a stimulant fomentation to cleanse the ulcer, or to abate any pain or inflammation which our medicines may have raised; but a continued use of common poultice, of carrot poultice, of stale beer poultice, or any other, serves rather to relax and hurt the part, though very proper on some occasions. I believe, that very universally the cure depends on the prudent use of astringents, escharotics, and caustics, which must be changed according to the condition of the parts, and most especially it depends on perfect cleanliness and a firm bandage. If the sore be going slowly but regularly on, it requires only such slightly stimulant ointments as Turner's cerate, or unguentum tutiæ, or some other ointment made with zinc. If it be red and fresh granulating, let it be dressed with dry lint in the basin of the ulcer, and straps of lint spread with ointment round the edge. If the action of the parts flags at times, and the sore looks gleety and pale, use a stimulating lotion at every dressing; sharpen the ointment by adding a little red precipitate to it, or ærugo, or a little dried alum. If the edges are quite callous, they must either be touched with caustic daily, or pared with the knife; for if this be not done, the edge of the skin being by this callosity disengaged from the soft parts, shrinks and wastes. If the sore be flabby, with a profuse discharge, sharpen your ointment by adding to it some spirits of turpentine; the sore will often be so insensible as to require to be powdered with pure precipitate. If at any time these processes for stimulating a sore have been too suddenly entered upon, or too harshly followed up, so as to excite inflammation, you must apply a poultice, or rather a warm fomentation of camomile flowers, with crude sal-ammoniac, till you restore the ulcer to a quiet and easy condition. On the other hand, the sore will sometimes become so highly irritable, that the most mild anodyne washes will not be sufficient to allay the pain. In that case, dress with the Peruvian Balsam*.

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* C. B.

Perhaps on this, as on many other occasions, we look too anxiously towards the discovery of some particular cure, while we neglect to investigate the general nature of the disease, the only kind of reasoning which can lead to a just conclusion; it seems indeed as if, in many instances, we expected the cure of diseases from chance, having no confidence in those reasonings concerning the animal economy of which we are nevertheless so proud. That healthy but strong action which restores wounded parts, by producing adhesion, we have been long accustomed to consider as a stage of inflammation; and inflammation, of course, has been understood to perform, or at least to assist, in the cure of wounds. But I have ventured to protest, that inflammation is unequivocally and always a disease; that it is inflammation alone that prevents the cure of wounds, or converts a wound into a sore. I would now add, that inflammation either arises at the first from debility, or, at least, very soon produces it; that the inflammation which causes ulcer is founded in debility; and that an ulcer happens only in a debilitated part.

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* It is impossible to be serious while we enumerate the thousand remedies which have been applied to ulcers; not that our disappointment in removing so afflicting a complaint can be matter for ridicule, but the vain boastings of self-sufficient inventors surely are so. Ulcers have been dressed with precipitate, calomel, alum, vitriol, zinc, verdigrease, pulvis sabinæ, and other devilish drugs; they have been powdered with sugar, chalk, charcoal, assafœtida, rhubarb, and other innocent drugs; they have been plastered with turpentines, balsams, mel mercurialæ, decoctions of walnut leaves in sugar (which Belloste protests to be a medicine so powerful that no ulcer can resist it). I have seen ulcers, extending from the os ischium to the ham, or covering the whole back or thigh, like Joiner's, dressed, with what—why with garlic and spirits! while others have thought fit to dress them, like warts, with fasting spittle, or raw beef, or the gastric juice. Ulcers have been squeezed into a good humour by compresses and firm bandaging, strong sticking plasters, plates of lead fastened upon the shins, sponges, cakes of Paris plaster, &c.; or bladders have been fixed about ulcers full of fixed air, carbonic air, vital air: What is there, indeed, that has not been tried. If you should wish to see all this farrago of empyricism treated with the pomp and solemnity of science, look to a Treatise on Ulcers, in the Surgical Transactions. This singular suite of experiments (as they are called), consisted in trying all sorts of powders; and the precious additions that we have are, tartar emetic, true Turkey rhubarb, chalk, Paris plaster, cassada root, lapis calaminaris, ipecacuanha, the flour of mustard, gentian, camomile, Columba root. But I dare say the reader has enough of this.

The most tedious and persevering ulcers are those which arise from habitual debility! such are scrophulous and constitutional sores. The most ugly, destructive, and horrible ulcers, are those which arise from some poison infused into the system, destroying the temperament and living powers in the parts! such as the cancerous or venereal poisons, the sibbens, the yaws, the rot poison*. The ulcers which are the most in danger of becoming gangrenous, are those where the vis vitæ of the whole constitution, or of the particular part, is destroyed; as in dropsy, or in fractures of the spine. The ulcers which are the most fearfully rapid, are those of hospitals and camps, which arise from what I may call a concealed fever lurking in the constitution, which shows itself sometimes in the constitution by an inexplicable disorder, paleness, faintness, nausea, diarrhœa, a quick, hard, and fretful pulse, and a continual threatening of fever; and frequently by rapid changes of the sore, and even, at times, sudden gangrene without previous fever. The habitual ulcer of warm climates is owing to that uninterrupted debility of constitution which shows itself in various forms of disease: sometimes it appears in the form of fever, sometimes of a dysentery, sometimes of intermittent, sometimes the person so debilitated is subject to the liver disease, sometimes to the Cochin or Barbadoes leg, and very often to constitutional ulcer. In those persons with whom the constitutional disorder of warm climates is not so far advanced as to produce spontaneous ulcer, every wound is yet sure to degenerate into a sore; for in a system thus indisposed and weakened, the living powers of any individual part are apt to be suddenly exhausted, are unable to sustain a high or long continued action; and hence probably a wound becomes an ulcer, inflames and swells, with a profusion of undigested matter. All this points to the constitution.

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* For an account of the rot poison, vid. Paterson and Vaillant.

These are the various kinds of ulcer arising from constitutional debility; and every local debility produces in like manner local sores. Of these there are chiefly two kinds,—first, That which may happen to any part of the body where, in consequence of a wound, violent inflammation has ensued, carrying the excitement to that height, which the debilitated constitution of the part is unable to bear. Then the parts become flaccid, and run into ulcer, which is to be cured by exciting them, chiefly by those topical applications which I have just mentioned: Or, secondly, A local ulcer may arise from that peculiar weakness of the lower extremities, of which we have so many proofs; for it is there that leucophlegmatic swellings, varices, ulcers, and all the earliest marks of constitutional debility, first appear.

Of these ulcers, that which is in a manner peculiar to the lower extremities, is by far the most frequent. The cause of this weakness is merely the dependent posture of the parts; and it is surprising how often we have approached and yet misunderstood the true theory of this disease; to say that such an ulcer is difficult to cure, from the dependent posture of the part, appears too simple and obvious to be thought worthy of attention, and yet it is the truth, and probably the whole truth. This has long been obvious, and yet very little observed; it is as certainly known that an ulcer of the leg may be cured by keeping it on a level with the body, as that a suspensory bandage is useful in disease of the testicle or scrotum; an ulcer is cured merely by keeping the diseased limb in the horizontal posture; the patient walks abroad, and his disease returns! the surgeon sees the ulcer alternately cured, and breaking out, without ever apprehending that a steady and continued support is the only one thing wanting to a permanent recovery. Here we see the unhappy consequence of not having a right theory; hence it is that we travel unconscious, over and over, the very ground where our treasure lies hid: we have known the true cure for ulcers of the leg for half a century, we have sometimes succeeded, sometimes failed; we have at times come near to the perfect practice, then let it off, then resumed it again, and all from not knowing the meaning of the real import of those methods which are used, or the causes of our alternate successes and disappointments. We have long used bandages, leaden plates, adhesive plasters, sponges, and other means of compression, without knowing that it was by supporting the parts that these were sometimes successful. Even a word, a name, is of critical importance in a matter like this; had any of those who have pretended to cure ulcers by compression had the good fortune to say "they cured them by supporting the veins," then would they have caught even by the ear the true theory, they would have been careful not to make partial and painful compression by plates of lead, nor partial strictures by rollers bound only round the diseased part; they would have been careful to support the parts generally, and to apply their rollers from the very extremity; their bandages would have taken a very different form; they would have learnt that manner of bandaging for the cure of ulcer, which I shall explain to you more particularly in my next discourse. In the mean time, we shall look to the common varieties of ulcers, and notice the common applications and remedies. After which I shall employ myself rather in pointing out those peculiarities of ulcer which arise, after great wounds, from a peculiar condition of the fascia—from the accidental generation of worms—from uncleanliness, spoiling the texture of the skin—and from infection of hospital sore, or of any other prevailing disease.

COMMON VARIETIES OF ULCERS.

An ulcer has been already defined. We should next attend to the structure of an ulcer. It is covered, like the surface of an abscess, with a film of coagulable lymph, and out of this secreted layer of lymph the granulations are formed. Under and around an ulcer the fat is absorbed, and the cellular membrane condensed. And in a common ulcer, the surrounding skin is elevated above the surface of the sore, so that the ulcer appears deeper than it is in reality.

The granulations which cover or form the surface of an ulcer, are small convex, vascular, and secreting bodies, on the different condition of which the varieties in the appearance of ulcers depend. They are called healthy when they are firm, moderately red, and rise to a level with the skin. They are unhealthy, and have no tendency to heal, when they are soft, spongy, and rise above the skin; or when they are very pale, imperfect, and deficient in vigour. When the granulations waste (and they change their condition with remarkable rapidity), when they sink below the level of the skin, when they assume a fibrous appearance, and are pale, and when the edge of the skin is abrupt as if a portion had been cut off, then it is a chronic ulcer, and it will be difficult to rouse the surface into that activity which is a necessary harbinger of our success in curing it. We must apply the warm stimulating fomentation, touch the edges with caustics, wash the centre with various stimulating lotions, as tincture of myrrh, nitrous acid and water, and dress with unguentum elemi composition, or with the resinous ointments with red precipitate. If the granulations are pale and glossy, and the pus from it thin, the zinc lotion and zinc dressing, and the tar ointment, will agree with it, especially as it is probable, in such an appearance of the sore, the scrofulous constitution prevails. When an ulcer is deep, foul, and sloughy, with a dark inflammation around it, we put pledgits of lint, dipped in camphorated oil, within it, cover it with the carrot poultice or fomenting poultice, and at each dressing foment it for a quarter of an hour. The bowels must be opened with a warm purge, and the decoction of bark, with the acids, administered.

When a sore has a whitish spongy bottom, and the edges of the skin are jagged and sharp, it becomes irritable, and does not bear the dressings. Then the applications are poultice of cicuta, fomentation with poppies, or the tepid opiate solution, or we dress with the Peruvian balsam. Above all, we must notice the change of health which has produced this effect on the sore, and endeavour to correct it.

If the discharge from the ulcer is not purulent, but offensive, and mixed with blood; if the flesh below is soft and spongy, and the edge of the sore livid, we immediately direct our attention to the general condition of the patient: we find the gums spongy, and hard blotches or scales upon the skin, the legs ædematous, and that he complains of lassitude, with depression of spirits,—we have to apprehend a scorbutic ulcer: and we are confirmed in this, if we find on inquiry that the patient has suffered confinement and distress, with bad food, or deficient nourishment. We now apply lint, dipped in strong decoction of bark, to the sore. We do not give the patient bark, as in other forms of debility, but good food, fruit, lemon-juice, Madeira wine, spruce, and cider.

Another terrible scourge is the Phagedenic Ulcer. This also arises from an indefinable state of deranged health. Whilst there is an open ulcer, a constitutional change takes place, and suddenly the ulcer begins to eat and spread rapidly. In a common ulcer we see a sort of circumvallation, a swelling and thickening of the parts around the ulcer, as if to confine it; but in the Phagedenic sore there is no such thickening, the sore spreading, the parts waste altogether. It is not the mere shrinking of granulations, but the destruction of the substance altogether: so that if happily it is stopped there is a vacuity left. This process of ulceration will rapidly destroy the penis, or the integuments of the groin, and expose the great vessels. Anodyne fomentations, and a poultice of the fresh leaves of cicuta, are applied; the edges are washed with sulphate of copper, in camphor mixture, or with calomel in lime water. And now we administer the decoction and syrup of sarsaparilla, and the pill of cicuta and calomel (though sometimes mercury is the cause of this dreadful wasting of the parts). And here a circumstance presents which exhibits the puzzling nature of these ulcers. When we would suppose, naturally enough, that the patient is sunk in great debility, and misery is in the face, bleeding will stop the disease! When there is a bounding or jarring pulse, and heat of skin, we must have recourse to bleeding, either by the lancet or locally.

I shall presently show you the danger of performing operations when erysipelas prevails in an hospital; but the consideration of this rapidly wasting ulcer bids me guard you against making incisions of the skin in a certain state of debility of the constitution. The worst Phagedenic ulcers have their commencement in an incision made with the lancet or bistoury, when the constitution is loaded with mercury. Operations which, in a healthy condition, would be of no moment at all, are then dangerous.

You will very commonly find the general Fascia or tendinous sheath which covers the muscles much concerned in ulcer; and I am persuaded that the unyielding nature of this part, more frequently than any other cause, protracts the cure. An ulcer seldom penetrates deeper than the skin, it is seldom able entirely to perforate the fascia; it is the ill condition of this insensible part that makes a sore continue throwing off sloughs for months, and spreading continually; for this tendinous sheath which lies under the skin being dead, deprives the skin of nourishment, by destroying the intermediate vessels; the skin cannot close over a part which is dead, any more than flesh can close over a carious bone; nor can it continue sound at its edges, since its edges lie over the dead fascia, unconnected with it, and no longer nourished by vessels: the skin thus shrinks from a part with which it can hold no connexion, and the inflammation and the matter working backwards in every direction, destroy more and more the cellular substance which lies betwixt the fascia and the skin. This I know is the condition of most of those sailors' ulcers and hospital sores which I have seen: What can a sprinkling of precipitate, or of some drug still more insignificant, do in such a disease? The fascia, when once brought into this condition, is like a diseased bone, its connexions are strong, it does not slough off soon, but keeps its place. When we clean such a sore of perhaps three or four hands' breadth, we cannot but remark the strong analogy betwixt the matter which it discharges, and the stuff which we scrape off from an anatomical preparation, for there also it is the fascia belonging to the interstices of the muscles that produces that foul matter which costs us so much pains to clear away. Upon removing this cream-like stuff from the surface of a deep ulcer, we see the fascia covering the bottom like a sheet of soaked shamois leather; with such a bottom as this the ulcer can never heal, the fascia itself is dead, and will never recover; it sloughs off more slowly than even a diseased cartilage or bone. Now I know that this is often the impediment to the healing of great ulcers; that the ulcer is perpetuated only from this diseased and yet unyielding state of the fascia, and this has been the occasion of many losing their legs; it is the very ulcer for which many men are reported incurable, and discharged the service. The habit which first produces such an ulcer is very bad; the ulcer itself, which extends so as to uncover the fascia in this manner, cannot be easily cured, although the fascia were cut away; but while it is left the ulcer cannot heal, you must therefore learn to pare and clip the fascia; and it will be some encouragement to you to know that I have often cut it up with the knife, then pared the flaps with scissors, cleared the leg of it in a few days, and brought the ulcer very suddenly into a healthy and granulating state.

When ulcers are long neglected, the worms which breed in them give a dreadful appearance to the disease. This is a shocking accident, very often seen in moist and warm countries in the autumnal season, and when the surgeon is suddenly overpowered by the multitude of wounded brought in upon him. In hospitals, where men are brought with deep, large, long neglected sores, worms breed very fast, and most especially in those parts on which the patient lies, so as to prevent its being cleaned. "At Stirling in

Scotland," says Wiseman, "all those wounded in the back and hinder parts were full of maggots, not having been dressed for some days." Though plainly this kind of ulcer, the Ulcus Verminosum, proceeds from uncleanliness, from flies being allowed to deposit their eggs in a nidus, very fit for hatching them, yet with such rapidity are the worms brought forth, and such myriads are found crawling in the basin of a great sore, that one can almost excuse the ignorance of the older physicians, who absolutely believed that the worms were generated by putrefaction merely, without any deposition of eggs. Overcamp was so absurd as to imagine that the mucus of the guts, or of a sore, might be rolled up into the shape of worms, and at last get life and become real worms *. Christianus Steenvelt, in his letter to Bidloo, was the first who observed the real cause of the generation of worms in sores. He mentions the confused notions of Ruysch as being too equivocal to be understood or refuted; but we can have no difficulty in understanding the opinions of Ruysch; for though, in the passages which Steenvelt quotes, Ruysch works up the subject into a fine piece of learned confusion, yet one fact, in another part of Ruysch's works, intimates to us plainly, that he was of the old opinion. I dare say he believed with the other learned people that worms might pass by the blood and circulation into the liver and guts. Upon cutting open some thigh bones (old dissecting-room bones), he found flies in them, and wondered how they got there, never imagining that the flies might deposit their eggs, the eggs ripen into

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* Miravi satis non possum Overcampium, eo devenisse dementiæ, ut statuere non fuerit veritus, motu vermiculari materiam putrescentem posse converti, parari, disponi, formari, in vermes.

worms, the worms crawl in by holes of the nutritious arteries, to the medullary cavity of the bone, and there become chrysalises, and so change into flies! that the worms and the flies were generated there by putrefaction was surely the notion of Ruysch. In this state of the matter Christian Steenvelt was obliged to convince the medical world by a very plain experiment: in a case of compound fracture of the tibia, where there was an ulcer of this kind, he scooped out about fifty worms from the crater of the great ulcer, laid them by the kitchen stove, and gave them to the servant girl to nurse, which she did so faithfully, that they fed and fattened, changed into chrysalises, and the fourteenth day became flies*.

I never shall forget the sight I once saw in our well-regulated and cleanly hospital, where there was such an exhibition of ULCERA VERMINOSA, as perhaps never was seen, even by Paré at the siege of Turin. Dr. Aitken had taken an apprehension that we were too apt to trouble sores by officious dressing, and being deceived, like many others, by the wonderful reunion of fresh wounds, when laid together, and not dressed for eight days, he formed this promising conclusion,—That, as according to the common saying, the "blood is the best balsam for a wound," "its own foul matter should be the best balsam for a sore." He resolved not to dress the sores of the surgical wards at shorter periods than five or six days; but that the matter might not run through the bed during that period, he made the nurses gather all their old sponges, and applied to each sore a sponge. Four or five days after, a great many gentlemen attended in the wards, on the tiptoe of expectation for the further issue of this experiment. Each sore, as it was successively opened, was in a horrible condition; "The worms they crept in, and the worms they crept out," and the Doctor was in great disgrace till he discovered the cause. He had given the nurses very strict injunctions about cleansing their sponges, which they very strictly obeyed; but each sponge, after being washed, was laid by the window to dry; it was hatching season with the great flies, who were very glad of the sponges to deposit their eggs in; and when these eggs were laid into the sores, and kept there for some days, with all the advantages of such a situation, they did hatch with a vengeance*.

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* Vermes numero quinquaginta viveri moveri crescere cœperunt, hi capsula inclusi calidoque in loco depositi spatio sex dierum in chrysalides sive corpora oblonga duriusculo cortice vel cute contecta, efformabantur *famula mea hæc fovente sollicite* post quatuordecim dies in muscas mutabantur.

The military surgeon has very frequent occasion to see the ulcus verminosum in warm climates, and in much neglected sores; and though these myriads of worms were not actually to corrode nor irritate the ulcer, yet they are such an indication of its sadly neglected condition, that they must immediately be removed, let the accident which produced them be what it will. The sores must be washed clean, and dressed dry; and if worms should continue to be generated, decoctions must be applied, of wormwood, rue, or any bitter herbs, while camphorated spirit is sprinkled over the dressings, to prevent the flies settling on the sore. Bidloo, in the cure of those wormy pustules which he often saw in the camp, and which probably were owing to the men's sleeping on the ground, always used a mercurial wash; and Steenvelt, an ointment made of Venice turpentine, aloes, mercurius dulcis, and yolks of eggs mixed up; or he sprinkled the sore with a powder made of aloes, myrrh, and nitre, a composition which is often used by the army surgeons on the Continent, especially in gangrenes and gunshot wounds, with extensive caries of the bones. This powder will effectually prevent any accident of this kind, and contribute also to the cure of the sore*.

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* Dr Aitken's vindication of himself may be seen in his Principles of Surgery.

But it is not merely from this collection of vermin that uncleanliness makes formidable sores, for it will spoil the texture of the skin, and (without any other cause that we can perceive) produce the most extraordinary ulcers. I subjoin M'GILLIVRAY'S case, as an example the best calculated to explain this position; for his wound was extremely small, the ulcer which followed was very singular, both in extent and appearance, and was finally cured, rather by care and cleanliness than by surgery. Yet what is surgery in this case but cleanliness and care?

This man, who is about fifty years of age, was a serjeant in the sixty-eighth regiment, was landed on the Continent with Lord Moira's army, was in the siege of Nimeguen. When the Waal froze over, so that the French were able to cross it, they attacked the British army, and during the retreat this man was of the covering party, being one of about three hundred who had the care of the baggage. They were suddenly surrounded by three thousand French, who formed a circle, and cut them off from the camp, which was formed in a valley about the distance of two miles: he was standing by his baggage waggon firing, and had fired four or five rounds when he was wounded. He saw no man fall before himself; the last thing he remembered was to have seen an irregular fire upon his small party in all directions; he was sensible of being wounded, but felt no pain; fell forwards upon his face, and lay for a long while; and when his senses began to return, he found his hand lying upon his breast, over the wounded part, his hand and clothes bathed in blood. He turned on one side, and perceived himself in the midst of a group of French soldiers, who were looking upon him compassionately; when he stretched out his hands, they were affected with this sign of life; they raised him up, and continued supporting him; one of them put his canteen of spirits to his mouth, and gave him a little, which revived him. As soon as he was able to turn round, he saw his wife (who had also been shot,) fallen from the baggage waggon, and lying dead, and their little boy, then about two years old, climbing upon her breast. The soldiers led him up to the spot; he took the child into his arms, and wrapped it in his plaid, but they soon were sensible that he could not carry the child, and they took it from him. He pointed to the dead body, and offered them some crowns he had in his purse to bury it. They dug a hole, and were burying his wife, when the alarm having reached the English camp, the French were attacked in their turn, the baggage was retaken, but he and his boy were hurried away, and thrown into a French prison in Nimeguen, where he continued to suffer all kinds of misery for nearly three years.

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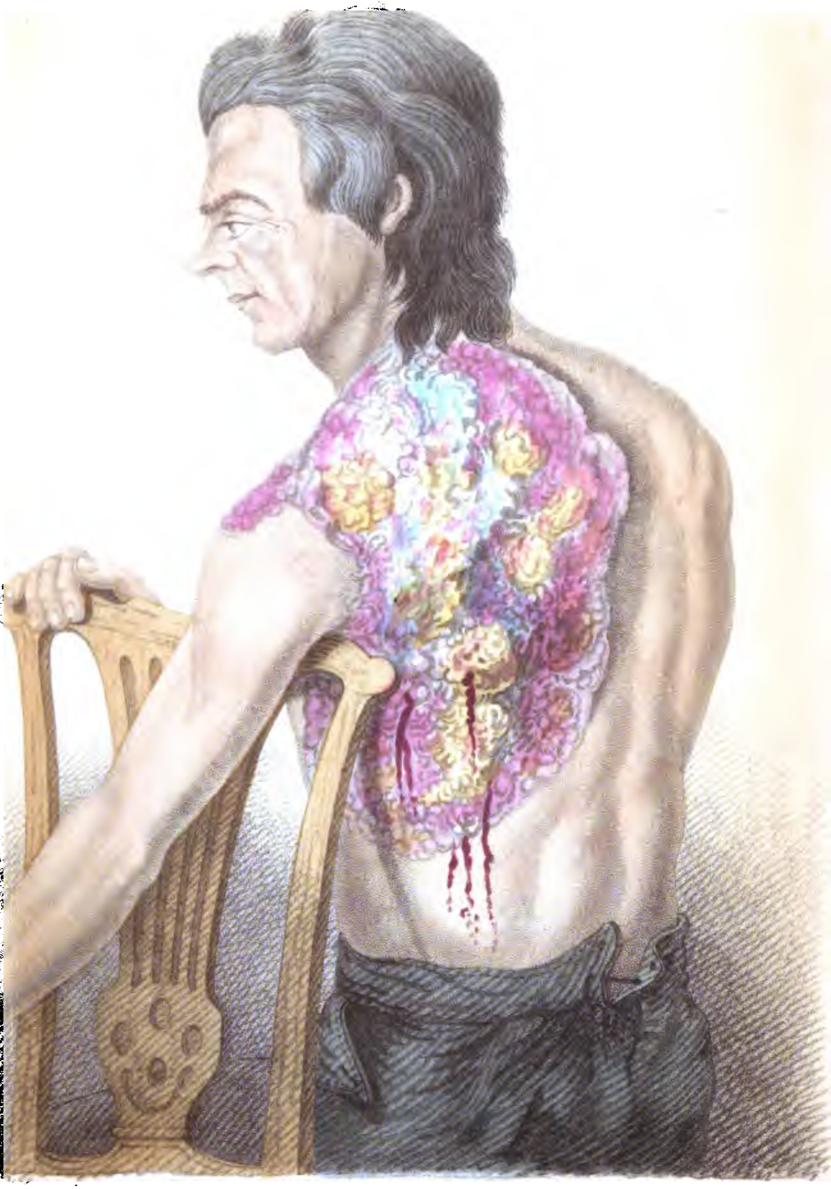
* These powders, as of rhubarb, bark, myrrh, and aloes, &c. when applied to sores or gangrenes, are not only useful by their stimulant powers, but are really the softest applications possible, and the best absorbents of foul matter. The Indians lay their little children in baskets filled with powder made of the barks of trees, where they lie soft and warm, and all moisture and filthiness is absorbed.

The ball had entered under the clavicle, and passed out behind; the great vessels had escaped, but the smaller arteries which were cut bled freely. It was three days before the French surgeon visited him; he passed a long probe through the wound, from back to breast, and drew after it a large skeine of cotton-wick, in hopes of entangling and drawing out any pieces of the coat or shirt, or shattered pieces of bone. This ball had entered beneath the clavicle, and passed out beneath the scapula: it had entered when he was stooping forward firing his piece; had crossed the thorax, which is very narrow at its upper part, raked all along under the scapula, and had come out pretty low in the back; not a bone was broken, nor was there any wound of the lungs, for he never had the slightest impediment in breathing, nor did he ever cough up blood. After this first visit he was so entirely neglected by the French surgeon, that he was obliged to have recourse to one of his fellow-prisoners to wash the wound, sometimes with a bit of sponge; he scraped his shirt into lint, and applied a little daily to each end of it. The miseries which he endured in various prisons for two years and eight months, brought the wounded part into the wretched condition in which it was when I saw it. In winter he suffered extreme cold; he lived on bread and water only; and of the black bread which he got, his allowance was but one pound a-day; no surgery, no opportunity of cleanliness, no care. After his health had been injured by cold and hunger, the heat of summer, in a close wooded country, corrupted the skin, and covered his shoulder with this terrible ulcer; half a year had elapsed from the time of his being wounded before the surrounding parts began to degenerate into this very singular sore.

The sore never appeared to heal during the heat of summer. The skin all around both wounds (and to great extent), grew livid and very dark coloured, then broke out into white pimples; the pimples afterwards burst, and discharged imperfectly a white viscid matter; two or three pimples ran together into one, and formed a sore; then a scab covered that sore, confined the matter, made the inflammation spread, and comprehended other pustules; these, again, were in their turn closed up, the skin was undermined by successive pustules uniting; from pustules they became abscesses, and from trivial abscesses, deep inflamed sores. During the progress of this ulcer, the fœtor of the matter was such, that the whole prison was infected with it. The poor man could indeed get his sore washed with water; but no diligence could mend his condition; the fœtor was quite sickening and oppressive to himself; the ulcer spread first round the wound in the breast, then round the back over the whole skin, which covers the shoulder joint, then over the scapula, then up the neck, and down the whole side; the skin became remarkably livid, every where greatly thickened: in one place, hard and callous, in another, soft and boggy, as if there were matter under it, although there was none; in one place an abscess was forming, near that was another abscess entirely ripe, and close to that another burst, and discharging yellow, very viscid, and mucous-like pus, which undermined and destroyed the skin. These various abscesses, in all stages of progress (like ripe and unripe fruit on one branch), worked, not superficially, but deeply, among the cellular substance, and the whole skin was puffed up; you might have felt the matter in these abscesses fully a month before they burst; and while they were working under the skin, the veins were eroded, and the blood burst out, sometimes so freely as to bleed like the vein of the arm. He frequently bled to the amount of two pounds at once, and much of the blood was, at the same time, driven under the skin, by which there was mixed with the dark red of this chronic inflammation the blackness of echymosis; and along with the hardness and callosity of inflamed skin, there was from point to point a pulpy feeling, as if of anasarca, echymosis, and abscess, united. There were besides two or three flat, thrombus-like tumours, fully three inches in diameter, which when pricked with the lancet emitted only blood.

This disease being merely a corruption of the skin, rising at first from his dirty and miserable situation, and perpetuated by one little abscess after another undermining and destroying the skin; the plan which I laid down for curing him was this: I ordered him the warm bath, gave him a purge, and put him on good diet, with a little wine; I directed the warm bath to be repeated three times a-week, to support a soft and pleasant state of the skin; and a fomentation of camomile decoction, crude sal-ammoniac, and a little spirits to animate the skin, was applied to the shoulder for one hour every morning and evening. The chief point was to manage the little abscesses



Drawn by J. Bell. *Engraved by J. Stewart.*

JAMES MACGILLIVRAY.

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and thrombuses so as to prevent their undermining the skin. I opened two or three with the knife; and taught his dresser how to cut each irregular abscess as it formed, down to the bottom, with a direct incision, till he reached the sound flesh. Each abscess was accordingly cut before it was fully formed with the knife, if large, (as some of them were three inches long), and with the lancet, if small. The incisions were not made in what may properly be called an abscess, but through a piece of diseased, spongy, and suppurating skin. The matter and blood were thus prevented from undermining the skin; the inflammation was drawn away from the swelled parts towards those occasional incisions, which became then, as it were, the centres to their own proportion of the disease, and each scarification was filled with a strong mercurial ointment, rubbed in very thoroughly with a hair pencil. The consequence was, that each incision being stimulated into a right and healthy suppuration, was made to relieve the adjoining skin before it was permitted to heal. By these practices, varied according to the circumstances, this strange disease was entirely cured; it had continued two years and nine months; but by persevering in this plan, especially in respect of the scarification, (which was indeed a daily and severe operation), he recovered perfectly in six weeks. Even the dark colour of the skin almost disappeared, and it became soft, pliable, and clean.

Excepting such ulcers as these which I have described, none, I believe, are entirely local; every great ulcerated wound becomes so from a fault in the constitution, not from the ill disposition of the particular part. This at least is the case in every dangerous ulcer; and this observation very naturally occurs to me, when I proceed, next, to speak of the HOSPITAL SORE, which I would not regard as a mere ulcer, to be treated like other common ulcers, but as a general affection of the system, a mortal disease; for when it rages in a great hospital it is like a plague; few who are seized with it can escape.

There is no hospital, however small, airy, or well regulated, where this epidemic ulcer is not to be found at times; and then no operation dare be performed, every cure stands still, every wound becomes a sore, and every sore is apt to run into gangrene; but in great hospitals especially, it prevails at all times, and is a real gangrene; it has been named the Hospital Gangrene; and such were its ravages in the Hotel Dieu of Paris (that great storehouse of corruption and disease), that the surgeons did not dare to call it by its true name; they called it the rottenness, foulness, sloughing of the sore; the word hospital gangrene, they durst not pronounce, for it sounded like a death-bell*; at the hearing of that ominous word, the patients gave themselves up for lost. In the Hotel Dieu this gangrene raged without intermission for two hundred years, till, of late, under the new government of France, the hospital has been reformed. " A young surgeon (says an ancient French author) who is bred in the Hotel

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* La Motte says, " Mortification ce qu'on appelle Pouriteur à L'Hotel Dieu de Paris, laquelle survient et accompagne presque toutes les playes qui sont traitté dans cette hospital," p. 330. And the disease was not named, " dans la crainte d'inquieter ces blessez qui croiroient etre perdus des que l'on appelleroit cette pourriture, Gangrene."

Dieu, may learn the various forms of incisions, operations too, and the manner of dressing wounds; but the way of curing wounds he cannot learn. Every patient he takes in hand (do what he will) must die of gangrene." Nothing, perhaps, will contribute so much to your understanding this disease, as a plain description of it in the form of an individual case.

Joiner, a boy belonging to the Triumph, whose ulcer I have drawn, received but a very slight and superficial wound, and for some time after the battle he continued in health, and the wound healed rapidly. But while it was to all appearance florid and healthy, with no threatening of ulceration, the boy in full spirits and strength, walking about on crutches, guilty of no irregularity, it began to look ill; a sure presage of some change of health.

There came on a cough, with symptoms of a common cold, which he imputed to his bed being placed near a door, lately open and now shut, but not walled up; then his health failed, his spirits became quite oppressed; he had occasional attacks of fever, frequent vomiting, and a continual loathing of food. With these slight and seemingly unimportant symptoms (but the tendency of such symptoms when they appear in a foul hospital is easily understood), his sore, which was no bigger than the palm of the hand, became in two days as big as the crown of a hat, in one week it grew as large as represented in the drawing. The whole skin of the thigh was destroyed, the muscles were stripped of skin and fascia from the hip to the knee, the trochanter was almost laid bare, the hamstring muscles exposed to a considerable extent, and all the muscles of the thigh dissected in a manner which no drawing can express.

While these ulcers made their dreadful progress in any of the wounded, I could observe them pass through the several stages, first of inflammation, then of insensibility and gangrene, and then of renewed pain and sensibility. First, when the health is affected, the patient has shiverings, languishes for a few days, and the sore inflames; then come vomitings, diarrhœa, and a distinct fever, and the disease seizes plainly upon the wounded part. In its first stage the wound swells, the skin retracts, wastes, has a dark erysipelatous redness verging to black, the cellular membrane under the skin is melted down into a fœtid mucus, and the fascia is exposed. But in the second stage, the fascia and skin, unable to bear their inflammation, and deprived of mutual support, become black, fœtid, soft, and fall into perfect gangrene; yet there are no vesicles, and the mortification is confined within the cavity of the sore. This is the stage of insensibility; the parts within are covered and defended with a perfect slough, which no medicine can penetrate, on which no applications can make any impression; and stimulants are used, without pain, of such a hot and fiery nature, as none but dead parts could resist: But when these sloughs open in the natural course of the disease, and the living parts are exposed, and the medicines begin to make an impression, it is imagined that these applications are restoring life and energy to parts which, before they were applied, seemed entirely dead! It is under this impression,

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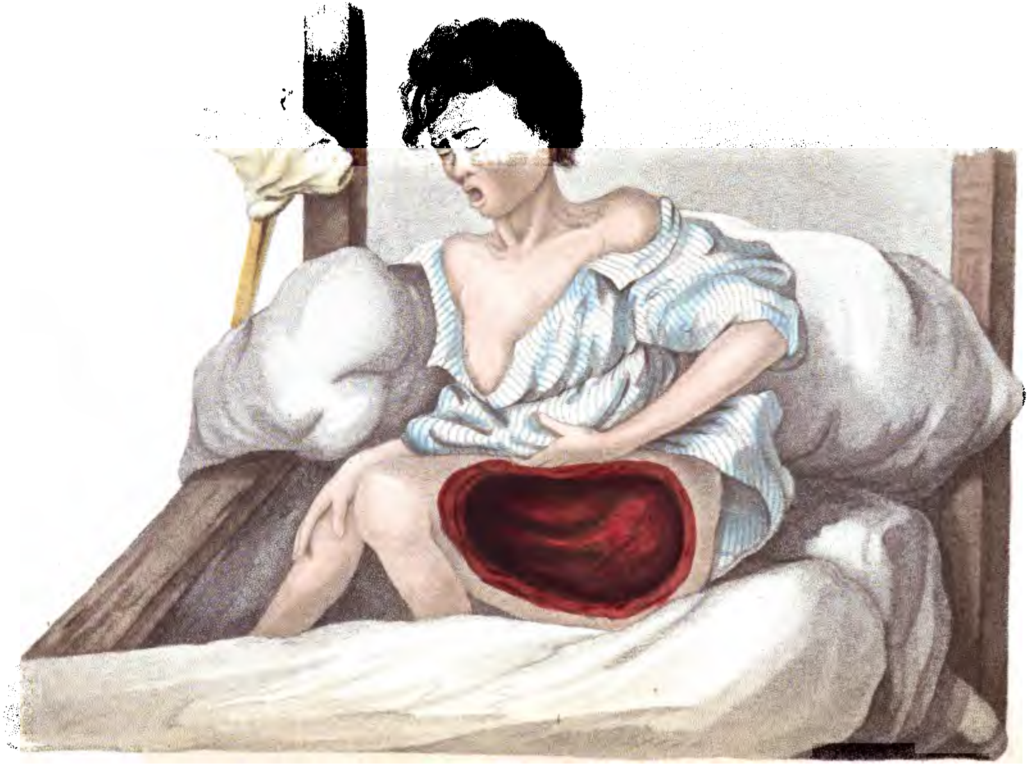

Drawn by J. Bell.

Engraved by J. Stewart.

JOINER,

A BOY of the TRIUMPH.

that stimulants are continued of a strength which parts thus inflamed cannot bear; the disease is aggravated by them, and the cries from all sides are such as would melt the most rugged nature.

In the third stage, this gangrene ceases, the sloughs fall off, the muscles become exposed, the part assumes once more the appearance of a common sore, but fearfully enlarged; a high and glossy red, and a smooth, shining, uninterrupted surface, mark the continuance of the inflammation and disease; but if the sores are to do well, it is known by a rough, granulating surface, somewhat dry, and of a paler colour.

If the patient is to die, the gangrene or wasting of the cellular sheaths proceeds; the skin first sloughs off; then the fascia is destroyed; those divisions and lamellæ of the fascia, which dive betwixt the muscles to enclose, protect, and nourish them, are next affected; the matter continues slimy and thick, and in prodigious quantities; the muscles are divided from each other more and more. In many who suffered under the disease at the same time with Joiner (the boy above mentioned), you could have laid your hand edgeways betwixt the several muscles of the thigh. Then the vomiting, diarrhœa, and nervous symptoms increase, the pain is dreadful; the cries of the sufferers are the same in the night as in the day-time; they are exhausted in the course of a week, and die: or if they survive, and the ulcers continue to eat down and disjoin the muscles, the great vessels are at last exposed and eroded, and they bleed to death. Thus a lad of the name of Handling, who had at the first but a slight wound in the thigh, had the cellular membrane, in the course of a few days, so destroyed, that you could put your clenched fist into the hip, and could lay the hand sideways betwixt any two muscles of the thigh. You could have counted each muscle, as in a dissection, from the tuber ischii to the ham. The branches of the Profunda Femoris first gave way, then the Sciatic vessels; for three nights he lost two or three pounds of blood each night; it would have been almost cruel to stop the hæmorrhagy, had it been possible, so very desperate was his situation; on the fourth day he died. I hope and believe that these scenes have made a lasting impression on the few who witnessed them.

These are the forms which this disease assumes when it attacks an amputated stump, a broad and open wound, a laceration of the skin, or any surface which is apt to become a flat sore. But when it attacks a narrow wound, as a bullet wound, a wound with any pointed instrument, even the prick of a nail in the finger, it assumes at once the form of an Erysipelatous Gangrene (Erysipelas Gangrenosa); and when this disease prevails in the hospital, you may see even a NURSE, from some slight hurt in the hand, which at another time could have done no harm, have one day a swelling of the wound, on the next an erysipelas of the arm, with dreadful pain and low fever; on the third day the arm will become livid, and covered with vesicles, and in two days more fall into gangrene; the woman oppressed in the mean while with hiccup, low delirium, and other symptoms of approaching death.

The wounds which are most apt to be seized with this hospital gangrene, are those which are flat and open, because in them much of the skin has been torn away. Tucker, a boy also belonging to the Triumph, who lay in the bed next to Joiner, had like him received a superficial and open wound, or a scratch rather, upon the loins from a splinter of wood. This dreadful infection seized also upon his wound, and the ulcer extended over the loins, over both buttocks, and part of both thighs; he could lie only on his belly, and, like Joiner, cried in a most lamentable manner. A flap of skin torn down by splinters from the arm or thigh is sure to run into this kind of gangrene. James Buck, a sailor, was wounded with a splinter of wood, which tore away a flap of skin from the fore part of the thigh, cutting it as clean as if it had been done by the surgical knife. Two small arteries required to be tied, a venous oozing from the lacerated Saphena vein continued for two days; but this ceased; his wound contracted fast; he was able to go upon crutches, and was allowed to indulge himself abroad. You know well that a sailor's indulgences, after long confinement, are of a coarse kind for a sick man. We found that he had been often drunk, was frequently revelling all night in the streets, and when day-light approached he scrambled over the hospital wall, or through the ditch full of mud. Frequent debauches, and the cold of winter, exposed him to the infection of the house; he was weakened, fell sick, the hospital sore spread over his thigh to a most dreadful degree; but wine and opiates, and careful living, brought him right again; and he was one of the few who had a prospect, when I left him, of recovering from the disease.

Attwood, a corporal of marines, was wounded by a great splinter of wood, which struck him in the arm, so obliquely, that without breaking the bone, hurting the muscles, or wounding any great vessel, it tore down a long flap of skin, from the top of the arm to the elbow: it was not ruffled and furled up, but left adhering only by its lower end, and separated so clean, that it hung from the elbow like a flat strap of leather, and there could be no doubt about cutting it away. Such a wound is, by a judicious surgeon, sent into an hospital with great reluctance; the man is a sure victim to the hospital gangrene; he goes like a sheep to the slaughter. Yet, for a month nearly, this wound did well; when the man, beginning to find himself too well, got abroad, was drunk every night, and rioting in the streets, and was exposed during intoxication to extreme cold, two depressing powers, which, in a particular manner, subject the system to the hospital gangrene. It may easily be imagined, that a man living in this idle way used many dangerous freedoms with his arm, so that it was very ready to inflame as soon as his general system began to fail. The hospital sore is usually preceded by a degree of fever; the health languishes, the appetite decreases, the patient rejects his food, the tongue becomes very foul, with thirst, and a small, weak, quick pulse: there is a latent fever, or tendency to fever, and very generally a diarrhœa ensues. Attwood being seized with these symtoms, his arm swelled, the edges of the wound rose much above the level, the whole skin became black, and sloughed off in flakes, the fascia fell off together with the skin, the muscles wasted so in a few days that nothing was left but the bone, covered, as it were, with a sort of moss, or efflorescence, of clear, red granulations; the one-half of the arm is now lost;

and though the ulcer should be cured, which I question very much, the arm would be useless for life.

Thus we find superficial ulcers, splinter wounds, the flat surfaces of stumps, or any open surface, the most apt to be seized with the hospital gangrene; but when the disease rages, nothing can resist it. One of the ugliest ulcers among those who survived the disease, proceeded from a penetrating wound. It was in one Sherridan, a seaman of the Belliqueux. There was in the wound of his arm, unquestionably, no ball nor splinter of shot, and therefore there was every reason to believe the wound to have been made by the point of some long shaft-like splinter, which had immediately dropped out again. The wound was on the outside and middle of the arm somewhat ragged, and very deep, as if the splinter had passed by the side of the bone. The opening of the wound was very narrow, the circle of it red and turgid, the matter sanious, and the arm, though not much swelled, was in great pain. The wound was, very properly, dilated; but as the splinter had almost transfixed the arm, perhaps it would have been more fortunate if the probe had been introduced, and cut upon, a counter opening made, and a seton passed through that counter opening; and this, if to be done at all, should have been done at the first; for in men who are to be thrown into a foul hospital, incisions are particularly apt to go wrong; and I think I have observed, that the stimulus of a seton, together with the smallness of the opening which the seton requires, keeps the wound in better condition than the dilating it with the knife. While this man remained at sick-quarters (i. e. at country lodgings), his arm healed, and it even continued well for some time after he was brought into the hospital; but it was not long before he lost his health: the sore inflamed, and in a few days the hospital gangrene carried away all the skin and muscles, from the shoulder down to the bellies of the supinator muscles; the fore-arm, especially at the elbow, swelled; the arm wasted, and the flesh was so destroyed by this horrible ulcer, that when the sloughing was over, nothing seemed to be left of the arm except the bone, covered with a velvet-like surface of shining red flesh, like that represented in Joiner's hip.

A stump which has not adhered is a flat wound, peculiarly apt to be seized with this dreadful disorder; and in wards where the disease prevails, amputation should not be performed. It is almost impossible to heal the stump; it sloughs, ulcerates, shrinks, becomes pyramidal; and to the very last moment of its healing, and even when the scar seems formed, or is about to be formed, the patient is liable to rigors, slight vomiting, a quick and irritable pulse; and then, in the course of a few days, the stump is burst open by inflammation, and spreads itself into a broader surface than even when the limb was cut off. In one day I saw three stumps burst open in this manner, each of which was so nearly cicatrized, that you could have covered the small spot that was left unhealed with the tip of the little finger. One of the men to whom this happened was Thomas Crouch, whose stump is drawn in the Chapter on Diseased Stumps. His arm was struck by a great shot, and left hanging by one rag of flesh; the bone was sadly shattered; the rag of flesh which held the arm was cut off; the surgeon thrust his finger into the hollow of the mashed and lacerated stump, and the bone was found to be split and shattered a considerable way up. The arm was amputated three or four inches above the wound, and it was cured in six weeks; not the breadth of a sixpence being left unhealed. He had been often seen in the streets drunk: by such irregularities he had so debilitated his system, as to expose himself to the hospital sore; his stump gradually opened wider and wider; the flesh shrank from the bone, the bone lay uncovered in the hollow of the stump, and began to exfoliate. The drawing is taken at the time of the sore's being expanded to a surface much broader than at first, because now, in addition to the natural size of the parts, the whole circle or border of the stump was greatly inflamed and swelled. The danger of this inflammation and ulcer of the stump is extreme; the least evil that can ensue from it is a great wasting of substance, an exfoliation of the bone, and a conical stump: but we are often disappointed even of this imperfect cure, viz. in the form of a conical stump; for it happens in an ulcerating stump, as in other sores, that the greater arteries are eroded, and then the patient almost inevitably dies.

This you perceive, gentlemen, is a very dreadful disease; it is indeed a study in itself, and therefore the observations I have here to lay before you must be very limited.

We have no reason to consider this as a local disease, nor can almost any ulcer be considered as entirely local. We see parts injured in every possible way, yet no injury of the parts produces a permanent sore; we see parts ruined in their texture by contusion of machinery, or by stones, beams of wood, &c. falling upon them; we see parts entirely killed by the contusion of shot; we see them irritated by spoiled bones and balls, and splinters buried in the flesh; we see wounds teazed with tents, caustics, cathartics, or corrosive and irritating medicines, without ulcer being produced; we may do what we will to the part, without producing ulcer, if we hurt the part only. While there is no predisposition or general disease, our greatest imprudencies produce but superficial sores; there is, on the contrary, when parts are irritated and vexed (at least in a healthy constitution), a perpetual resistance and tendency to heal: nay, when it becomes our duty to establish a discharge, a perpetual ulcer can hardly be maintained; it is done with difficulty, even by beggars and gypsies, more cunning in this respect than surgeons. Excepting that habitual ulcer which arises from the dependent posture of the lower extremity, all ulcers, great and small, have their cause in the general constitution, not in the part. Inflammation itself may or may not consist in debility; but it is surely from debility, or exhausted excitability, that a part sinks under the disease; for if, in the case of a wound, the system or the part have sufficient strength to support the action, the part will suppurate, granulate, and heal; but if the system be irritable and weak in an extreme degree, the part is quickly exhausted of its excitability; it is no longer able to bear the action; the inflammation overpowers it, and it sinks under the disease.

A man may be healthy when he receives a wound, and the system being full of vigour, the parts may be able to support their inflammation; but the moment that he loses his health, the excitability of the part is liable to be borne down by that degree of inflammation which it sustained while the system was healthy, but which it is now no longer able to support. The parts sink under the action: that action is no more violent than it was at first, but the part is less able to endure it; and thus, as soon as any new sickness shows itself, and especially when the system is attacked with this hospital fever, the wound becomes livid and gangrenous, and takes the appearance of a gangrene from cold, of a poisoned wound, or of that kind of gangrenous ulcer which is produced by scarifications, or slight wounds in a dropsical or paralytic limb.

These are the consequences, not of that infection only which we call the Hospital Gangrene, but of every debilitating cause. Drunkenness and debauchery, stomach complaints, vomiting, diarrhœa, low spirits, the return of an old intermittent fever, the infection of dysentery, any debilitating cause, will produce a change in the appearance of a wound. But this infection of the hospital is the most irresistible of all. The moment that a man is struck with it, you may observe him become pale, sallow, languid, low-spirited, with a heavy eye, a confused head, a loathing of food, a fretful pulse, and, in short, a universal disorder, which he can neither account for nor describe; and whether this disease appear first in the system, or in the part wounded, its progress is the same. When I have observed in any case the sore to be first affected, I have noted it as a sure symptom of the approaching disorder of the whole system; or when the system was first affected, I have marked that as a sure presage of the sad change that was soon to appear in the sore. He must, indeed, be very ignorant who disputes this hospital sore's being a general disease of the system; he must have observed very little, who does not know it to be absolutely an infection. To what other cause can it be ascribed? To a scorbutic and bad habit of body? Surely not; for the boys of the ship, who run about continually, and from their spirits and exercise are always in health, are the first affected with hospital sore: but those chiefly subject to the scurvy are the landsmen, who are unhappy in a sea life, impressed men who have been torn from their friends, or lazy skulkers, who never move but to the sound of the boatswain's whistle. Neither can we attribute it to the unhealthy state of the crew of a particular ship; for the wounded of such ship are unavoidably dispersed; some are at sick-quarters, and they get well; some are carried into the hospital, and they become diseased; and sometimes when those hospital patients are carried out again to sick-quarters, they recover their former health. Thus we see this disease confined within the walls of an hospital; nor does it always extend farther than a single ward. In Yarmouth, the English seamen who were wounded on the 11th October were divided from three hundred wounded men of the Dutch by a wall only: the great wards were on the opposite sides of the partition under one roof; on the one side of that partition we operated on men and boys, opened sinuses, or searched for balls or pieces of shot, as freely as in the most healthy hospital, or in sick-quarters; not a sore was to be seen there, except such as were the inevitable consequence of gunshot wounds, with carious bones. But on the other side of the partition wall were such sores as are seldom to be seen, prohibiting all operations even the most trivial.

Indeed, from all that I ever could observe, the vulgar expression, of the tainted air of an hospital, is not incorrect. This ulcer and gangrene is, in an hospital of wounded men, what puerperal fever is in a lying-in ward; it is an infection to which all are equally exposed; but it is resisted by health and strength, and favoured by weakness or disease. Excesses, drunkennesses, cold, and every cause of weakness, expose the constitution to its attack. If diarrhœa, fever, dysentery, or an old intermittent, or even a common cold, attack a wounded man who lies in an unhealthy hospital, the first febrile symptoms are immediately followed by this terrible disease. Though we often mistake these debilitating powers for principal, I suspect that they are but predisposing causes, and that the disease of the hospital, like a peculiar typhus, or the ulcerated sore throat, is still the same. What, then, is the surgeon to do? Is he to try experiments with ointments and plasters, while men are dying around him? Is he to seek for washes or dressings to cure such a disease as this? Is he to expend butts of wine contending, as it were, against the elements? No! Let him bear this always in mind, that no dressings have ever been found to stop this ulcer; that no quantities of wine or bark which a man can bear, have ever retarded this gangrene; let him bear in mind, that this is an hospital disease; that without the circle of the infected walls the men are safe: let him, therefore, hurry them out of this house of death; let him change the wards, let him take possession of some empty house, and so carry his patients into good air; let him lay them in a school-room, a church, on a dunghill, or in a stable; let him carry them anywhere but to their graves. No expense should be spared; for these are men who have entitled themselves to care, by every claim which men can have; and no one will dare to check the surgeon in these his most important duties. You are not sent out with only the amputation-knife in your hands; you are appointed to save the lives of your sailors or soldiers by all possible means: you are to conduct yourselves not like mere mechanical surgeons, like men capable only of doing over again what they have seen or heard described in schools, nor like men without sense, reflection, prudence, or those free and manly conceptions which your distinguished situation and new and various duties require. You would willingly expend your own fortune in such a cause,—then do not grudge to employ the revenue of the state, for it is employing and not abusing it! this is not profusion, but the wisest and best economy: if in the course of a few weeks sixty men die of the disease in your hospital, government has lost a sum which would trebly buy your hospital itself! The gross value of so many men in money, as they are reckoned on the muster books, being full fifteen thousand pounds.

Till some change of situation be accomplished, little can be done for men labouring under this plague; but when the disease first breaks out and rages, and while you are meditating some change, or concerting plans for suppressing the disease, you will find opium of infinite service in checking the diarrhœa and fever, for these are greatly aggravated by the irritation and pain: You must try to support the strength of your people by wine and cordials, and generous food, administered sparingly; and be careful not to overload their stomachs with bark, at a time when they are little able to bear any thing but a decoction, or a small dose of the extract in wine. As for external applications, tinctures of myrrh, aloes, and other drugs, still more stimulant, are improperly used in this case; as they have no effect while the slough remains, and when it gives way, produce unspeakable torture. Of these I cannot approve: keep your tinctures and balsams for fistulas, and your torturing stimulants for those local diseases which may be cured by them; but this not being a local disease, cannot be cured by local applications, and therefore the mildest are the best; as, for instance, a solution of cerussa acetata, with opium, which is a gentle astringent.

The hospital sore is a general disease, in which your whole attention is to be directed to the state of the system, and that is such as will not be easily set to rights. But there is one general fact which is very interesting: we cannot but observe how much and how suddenly the powers of the living system rise after being depressed; we cannot but remark how after a short fever the system acts with uncommon vigour, how every disease disappears before the fever, and how the patient thrives after it is gone. It is on this ground that in the beginning of all fevers I still approve the old practice of vomits, purges, and abstinence, by which I often see the system recovered from its oppression, and restored to that freedom of action, and that aptitude for stimuli, upon which much of the cure depends, and by which the system is prepared, as it were, for the action of those powers, as opium, bark, wine, and mild but nourishing diet, upon which we are to trust for accomplishing the cure. I think that in this hospital ulcer I have seen such practice useful; but I am so undecided with regard to the true practice in this disease, that I speak with diffidence, and would have you, if you do venture into this difficult path, proceed with so much caution, that you may, as it were, feel your own way; if you use evacuations, or a strict diet, it is but for a time, and in the expectation of renewing your stimuli gradually, and giving them a greater power over the system. I have always regarded the fear of evacuations as a vulgar apprehension; I am persuaded, that moderate evacuations have no effect in producing debility; that evacuations, by freeing the primæ viæ, or the circulating system, from an unmanageable burthen, often revive the strength; that healthy solids will soon form new fluids; and if the solids be in a high and healthful state of activity, it signifies little, comparatively speaking, whether there be one particle of food in the primæ viæ, or one drop of blood in the arteries more than is barely necessary to preserve them in action.

I have but a short comment to make on the subject of hospital gangrene. It is in fact a bad or malignant erysipelas. To preserve an hospital free from it, it is necessary that it be clean and well ventilated. When I find a patient seized with shivering, and looking pale and sick, and when on turning down the clothes I see the wound looking dull, and the surrounding skin with a dark inflammation, and especially when, from similar occurrences and the state of the house, I suspect erysipelas and sloughing, I absolutely find nothing to be depended on but changing the patient, taking him out of that ward, placing him in an empty one, or in the operation theatre, or any where, in short, that there may be a change of air, with a clean bed and bedclothes. Then the treatment as for erysipelas will be attended with the most favourable consequences, and ultimate recovery.

I began this discourse with the design of explaining to you only in a very general way the ordinary duties of a surgeon; and if I have been induced to speak more fully on some interesting points too little regarded in the common books of surgery, it is because in these duties there is more usefulness than show; they are daily cares, more honourable, in my mind, than bloody incisions! Perhaps, the sorest reproach against the authors of such books would be to say, that they have not understood those duties; but surely the greatest misfortune that could befal you, as young men, would be the learning to neglect them. If the directions which I have laid down should enable you to go your rounds in the hospital with a quicker eye, and clearer understanding of the cases that are committed to your care, and a more perfect command of the ordinary remedies, I shall be very highly gratified: and if you can once bring yourselves to like a discourse on such ordinary concerns as these, better than one which is more argumentative or learned, I shall think it the strongest proof of your good sense, and the most perfect assurance that you will become good and useful surgeons.

ON THE MEDICAL TREATMENT OF DANGEROUS WOUNDS.

However worthy of your attention those rules of practice may be which I have been hitherto employed in teaching you, yet there are many things which it is more important for you to be acquainted with than the mere surgery of dilating wounds, or extracting balls. Thousands perish by diseases, while a very few die by the sword; and the fate of the wounded depends much upon their being kept free from those diseases which follow an army, like the vultures that hover over its course. The medical treatment, then, must be more important than the mere surgery of gunshot wounds; and I shall endeavour to explain to you how to conduct your patient through these dangers; by bleeding, while in danger of inflammation; by rich diet and wine, while undergoing a long and weakening suppuration; and by bark, when gangrene is likely to come on. And I shall explain to you, as well as I am able, all that hurts or heals his wound, and all that endangers his general constitution, or keeps it safe; for indeed upon these matters, more than upon the immediate wound itself, depends the patient's safety.

In a subject like this, there must, no doubt, be some great and leading idea, which, being seized and unfolded, would make every subordinate idea easy and intelligible, and render the whole line of conduct very direct and plain; but I am sure that this general idea cannot be made good to you without a knowledge of the whole subject, of which I must not suppose you are possessed. I am sure it will be right to depart from my usual plan, and, instead of a general and diffuse explanation, followed by closer rules, lay down the general rules first, and then proceed to deduce from the practice itself those principles, without which the subject can neither appear so natural and orderly, nor so simple as it should be, to be well understood.

I. When your wounded patient is first brought to you, he is in great confusion; there is a tremor, a tonic stiffness, or almost a convulsion of the whole frame; there is a coldness, fainting, and nervous affection: but it is merely a nervous affection, and you should treat it as such. You may expect it to subside in time, and therefore should give some warm cordial and large opiates to quiet the commotion: this is no time for bleeding, whatever the nature of the wound may be. If the stupor continue, you should give cordial draughts, and wine.

II. If, this nervous commotion being quieted, a sharp fever should come on, still do not bleed, but rather be upon the reserve; for perhaps this, which at first seems to be a pure inflammatory fever, may turn out to be a fit of an ague, to which the patient may perhaps be subject; it may be a low and malignant fever; it may be an attack of some camp disease: and if a diarrhœa, great weakness, and low muttering delirium, should come on immediately after you had bled your patient freely, you would be distressed at the thoughts of what you had done, and you would, indeed, have much to answer for.

III. Reserve your bleedings for those more dangerous cases, where high inflammation is so often fatal, and do not bleed in wounds of the hips, shoulders, or limbs; reserve bleeding for wounds of the breast, or belly, or great joints; for, in all wounds of cavities, inflammation, which can hardly be escaped, is the great danger.

IV. If a man be wounded after a full meal, there can be no doubt that a gentle vomiting must be useful, where it is allowed by the circumstances of the wound. The old physicians found their advantage in it, and ascribe the good effects of vomiting to the preventing of crude and ill concocted chyle from entering into the system, so as to kindle up a fever. There is no doubt that a meal, which was no load during health, will be a great oppression upon a disordered system, and the carrying it off must be a great relief; although the old physicians, by talking this useless jargon about ill concocted chyle, might almost provoke us to reject both the doctrine and the practice. The system cannot be weakened by a gentle emetic; and if the system should fall low after vomiting, it were easy to substitute a fitter support and better excitement than that of an oppressed stomach and loaded intestines, by first discharging these crude meals, and giving, when the stomach is emptied, easy food and cordials suited to the condition of the system.

V. But in every wound there comes a period of weakness, in which we repent of every bleeding that we may have made, even when it was really needed; a period in which, by confinement and pain, occasional fever, diarrhœa, profuse suppuration, or colliquative sweats, the patient falls so low, that it is not easy to support him through the cure; and thus there are two great principles in the treatment of gunshot wounds, that even at first we should be sparing of blood, and that the period of weakness which is to succeed is the greater danger—on this single point hangs all the practice.

We are not intitled to bleed in a mere flesh wound, because every gunshot wound is first to fall into a partial gangrene, then to give out a profuse suppuration; and if there be no wound of a joint, nor fractured bone, the first inflammation never runs too high.

Since, then, there is no danger from the present inflammation of a flesh wound, why should we waste that strength with bleedings which is soon to be so severely tried by weary confinement, great gleetings, profuse suppurations, and pain, and want of rest? Here we are to expect from time to time new collections of matter, new paroxysms of pain, new discharges as of the ball or of pieces of cloth, and still returning accessions of fever, which quite exhaust the patient, till in the end perhaps he dies.

Bleeding is to be used only in the spring, when new recruits have come into the field, full of young blood, and inclined to every inflammatory disease; in spring also, even the veteran soldiers have lain in cities during winter, and are recruited from the fatigues of their last campaign, so that they even will bear bleeding; in spring also the peripneumony, rheumatisms, and inflammatory diseases of all kinds, prevail. With officers also, it is plain, that bleeding may be more freely used than with common soldiers, for the officers feel less of the hardships of a soldier's life; the officer is fed, and clothed, and lodged well, and too often indulges in wine, and lives luxuriously, while his fellow soldiers are suffering the severity of the weather, and the want of clothing, with poor diet, unwholesome drink, and all other hardships of war. It is perhaps a proof of this that Mr. Ranby, in his book, gives no examples of success from free bleedings but in young men of high rank, most likely because those young men were better able to bear this practice; but I fear too there is something here of flattery to the great, a meanness from which the high abilities of Ranby should have exempted him. He must have felt, when he spoke only of the wounds of princes, that a poor fellow in the ranks was a fairer subject of observation, and his wound as good an argument in a point of practice as that of the heir apparent. If Ranby would show himself thus fond of curing princes, he should not have been ashamed also to speak of men.

I think it of more importance to repeat the cautions against bleeding, than to direct you when to bleed. I say you must not bleed so freely in common soldiers; you must not bleed those exhausted with the fatigues of a long campaign; you must not bleed in autumn, when diseases of weakness are frequent; you must not bleed in the midst of camp diseases, when dysenteries or fevers prevail; and in the foul air of hospitals, bleeding, how much soever it may seem required, should be done with a very sparing hand; and bleeding can hardly be necessary in a mere flesh wound.

It remains then for me to mark out for you the precise cases in which bleeding may be freely used.

You must bleed freely in all wounds of cavities, for there inflammation is the most immediate and pressing danger. Your bleedings should be for preventing the inflammation, for they will not cure it. If inflammation once come on fairly, you can hardly save.

If inflammation come upon the breast, the pulse rises, the patient breathes short, with such pain and oppression, that he is at last suffocated, and dies. If the belly be allowed to inflame, he dies in torments which are called "miserere mei," as not to be described. And as for the inflammation of a wounded joint, it is attended with such violent fever and racking pain, that the patient dies; or if he passes through those first dangers, it is only to die more slowly of the great discharges, while the eroded cartilages and thoroughly diseased bones extinguish all hopes of a cure.

Now, if a patient will keep such a limb, or if he be wounded in the belly, head, or breast, or perhaps with two such dangerous wounds, you must bleed him profusely—I had almost said, without bounds. But while I deliver this lesson, I cannot but remember to qualify and limit this rule of bleeding, by showing how much you may go beyond the mark.

The French surgeons are accustomed to bleeding, with a freedom which an English surgeon has no idea of, and can hardly excuse; for they bleed twice, thrice, or even four times in twenty-four hours, and continue it sometimes to the fifteenth or twentieth day; and there is no doubt that sometimes, by such profuse bleedings, they have saved those who would have been lost by a more timid practice; it is to this daring practice that I ascribe their success, sometimes wonderful, and especially so in wounds of the cavities or joints; but there are cases which might be produced from the best French writers, which should serve you rather as warnings than as examples; and I shall give you one notorious example from the practice of Mr. Ravaton, one of their most famous surgeons; a case which I mention the more willingly, because Mr. Ravaton seems conscious that he had gone too far, confessing freely, that his patient was saved rather by his own natural strength than by the surgeon's skill.

He was a young man belonging to a militia regiment, and was desperately wounded in a duel; and the corps wishing to conceal the affair, entreated Mr. Ravaton to receive him privately into his house. The sword had passed across the breast, in above the pap, and out betwixt the fourth and fifth rib behind; he was brought to the surgeon's house more dead than alive, insensible, without pulse, continually putting up blood; there being emphysema at each wound, Ravaton dilated both; the difficulty of breathing was such that he could not speak, but tossed himself in the bed from side to side, six times in a minute throwing about his legs and arms in great agony.

He was bled copiously five times in the space of three hours: before the evening he was able to speak, by eleven at night he was much relieved. So far every thing was well.

But here followed something still more daring. Mr. Ravaton ordered an apprentice to sit with lights in his room, and instructed him, that if this distress continued he should open the veins during the night. Mr. Ravaton, from his chamber, heard him crying out during all the night to be bled, and in the morning he found that the young man had drawn blood no less than nine times.

By this bleeding the patient had fallen into a state of insensibility, in which he lay for two days; and when he recovered he awoke as it were from a dream, neither remembering his having been wounded, nor having any consciousness for some time of his dangerous state. He complained no longer of the difficulty of breathing; and, by giving him nourishing soups and broths, Ravaton recovered him from his dangerous weakness; the cough, fever, excessive sweatings, gradually subsided, and on the twenty-second day he left Mr. Ravaton's house, though quite pale, and woefully reduced.

Ravaton words this account so cunningly as not to make any clear confession of his own rashness; but yet he gives a strong hint, that on the morning he really feared that his apprentice had bled this young officer once too often*.

Such imprudences as these I am sure you never will commit; for I know that it will be difficult for you to keep up your resolution to that assurance and boldness in bleeding which is really needful. You will be too fearful, I am persuaded, rather than too bold; and therefore I must conclude with observing, that even this bleeding was not fatal, and that in wounds of the bowels and joints bleeding can hardly be too profuse; but still you must be careful, that while you dare to do every thing that is necessary for present safety, you risk nothing which may produce future danger.

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* Ravaton, p. 260.

Thus you are to use bleeding boldly, but with discretion; you are to use it in the young and healthy, in wounds of the head, the breast, the belly, or of the great joints.

But this is not in the common course of things. Battles or sieges seldom take place in the spring; the army is moving easily; few are sick, and still fewer wounded; the few that are more slightly wounded are sent to lie in the nearest towns, and those who are wounded in the great cavities generally die.

But your practice begins when all manœuvring is over; and when, towards the end of the campaign, there have been great battles and sieges; when perhaps the army is retreating, while all around you is nothing but confusion and distress. The wounded increase in number; they are crowded into hospitals, and hurried from place to place; they are exhausted with the fatigues of the field, and their sickly constitutions are now entirely worn down with long suffering and pain. In short, thousands are in danger of low fever, while a very few only can need bleeding, or even be in danger of inflammation, unless indeed it be of that erysipelatous or gangrenous kind which is so frequent in hospitals and camps.

The second great principle, which I proposed to you somewhat in the form of a theory, is therefore more respectable than a mere theory. It is not so much a general theory, it is rather a general fact, and written in characters so plain that he that runs may read; and it is well that you be instructed in this; for though the omission of bleeding when required be a great fault, to bleed a man who is in danger of low fever, or labouring under a camp disease, were to loosen entirely the little hold he might have of life.

Perhaps it may not yet appear distinctly to you that there is any strict connexion betwixt the condition of the system and the easy healing of wounds, because you do not know that the fever which attends gunshot wounds is generally of the low kind, and that every thing that depresses the system, though but for a moment, changes the face of the wound.

The fever which attends an ill-conditioned gunshot wound is attended with great heat, thirst, a foul tongue, a low, quick, unequal pulse, and there is a low muttering delirium, or, as Ranby expresses it, the head not quite clear; and bark, wine, and elixir of vitriol, are to be used.

And as for the wound itself, the worst appearance of a gunshot wound always proceeds from weakness, arising from some very direct and manifest cause: nor does the wound ever look thoroughly ill, till the patient is weakened by long confinement or imprudent evacuations, or, as often happens, from excess of the natural discharge.

Ranby remarks, that the stump shall promise all imaginable success for eight or ten days, when, suddenly changing its complexion, it shall begin to gleet prodigiously, look pale, and flabby; "and this gleeting, or profuse discharge, runs the patient out of the world in a little while." The cause of this change on an amputated stump, or of the ill condition of any gunshot wound, is plainly weakness; for, if a patient be using the bark, or opium, or wine, if he be deprived of the support of these medicines for a single day the sores change; if he be seized with the fit of an old ague, or is attacked with dysentery, fever, or any camp disease, the appearance of the wound instantly changes; and, when at any time diarrhœa comes on, the wound is altered as suddenly as the complexion; and if the looseness continue but a few days, the wounds go all wrong, for the patient, being weakened, becomes cold in his extremities, his visage becomes ghastly and yellow, the stump looks flabby and pale, and the flesh separates from the bones, the bone projects, the relaxed vessels ooze out a bloody serum, and the blood lying from dressing to dressing produces a putrid sore, of which the patient dies.

If you are in a great hospital, you will perceive the stumps, the sores, the gunshot wounds, and the fractured limbs, all go wrong at once; any general cause of weakness, or fever, produces this change over the whole hospital, while any particular cause of weakness will produce it in any one individual case. The paroxysm of an intermittent fever, the accident of a foul stomach, two days of diarrhœa, will not only change the complexion of a sore, but will alter its nature in a degree not easily brought round again.

And in the largest hospital one foul sore or gangrenous limb, one unlucky fever, or the crowd of wounded which a battle pours in upon them, makes a whole hospital exhibit everywhere the same dismal scene.

The marks which distinguish this condition of the system are so plain, and the appearance of an ill-conditioned and flabby wound deluged with matter, and sometimes blackened with exuding blood, is so peculiar, that I hold this notice to be enough; only it will be right that I explain to you, before I descend to the particular rules of practice, how terrible the consequences of ill air are, whether in hospitals or in a camp.

It is very well known, that in the autumnal months, in marshy situations, in crowded hospitals, in besieged cities, where the whole country is driven in upon the town, wounds will never heal. Paré says*, that in the siege of Rouen the air was so noxious that no wounds would heal; and the besieged, finding that all their wounds became gangrenous, reported that the besiegers had poisoned their balls; the besiegers also, seeing none but putrid sores in the camp, believed that their wounds were poisoned; and, both within and without the city, such was the state of the air, and so putrid were all wounds, that the surgeons could scarcely look upon the sores, or endure the smell; and if they neglected them for a single day, they found them full of worms.

The history of one great hospital, the Hotel Dieu of Paris, which has been, I fear, an evil rather than a blessing to that city, has always appeared to me very curious.

Paré, two hundred years ago, complained that in the Hotel Dieu sores would not heal, and no operations could be rightly performed. After him Dionis, a hundred years ago, protests against performing operations in the Hotel Dieu; and advises, that an hospital should be built in the environs of the city, for those who, having fractured skulls, required the operation of the trepan. And M. Desault, late surgeon of the Hotel Dieu, said, that wherever he performed the operation of the trepan, his patients were sure to die; by letting them alone, they had some little chance of living. In his time, therefore, they tried to relieve depression, or coma, by bleedings, poultices, or blisters, but never ventured to perform the trepan.

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* Page 284.

The two great rules, then, which I have laid down for you are these:—To bleed only in the spring, when men are just come into the field full of young blood, lusty, and strong, disposed to inflammatory diseases. But in the autumnal months, in marshy situations, in crowded hospitals, or unhealthy camps, when the men having been exhausted with a long campaign, or having struggled through lingering wounds, you look only for weakness and fever, gleety stumps and foul sores; instead of bleeding, you must trust to air and cleanliness, and bark and wine.

This single principle will, I hope, make the whole business very plain to you; for, indeed, if a young man, without some leading principle, enter upon these duties—if he go into the camp with only some looser notions of bleeding in inflammation, or of bark when gangrene is to be feared—he will be little valued there: if he do not understand the connexion betwixt the particular wound and the general health—if he do not know with a glance the constitution of a patient, or the true state of his sore—if he be not careful to retain some general principle, which, like a mystic clue, may lead him through this labyrinth—he will see thousands dying around him, without knowing the cause, like the tale of the Grecian camp, falling under the invisible shafts of Apollo.

This general view will reduce your notions of practice into a simple and manageable system, and let you know what you are doing. You must always keep your eye upon the constitution of your patient, for there are many things more important to his health and safety than dilating his wound, or extracting the ball.

I. If your patient be an officer, well fed, and warmly clothed, in full health, riding perhaps a pleasant journey, while his men are marching, and living luxuriously while they are suffering the hardships of their way of life, he will bear bleeding well.

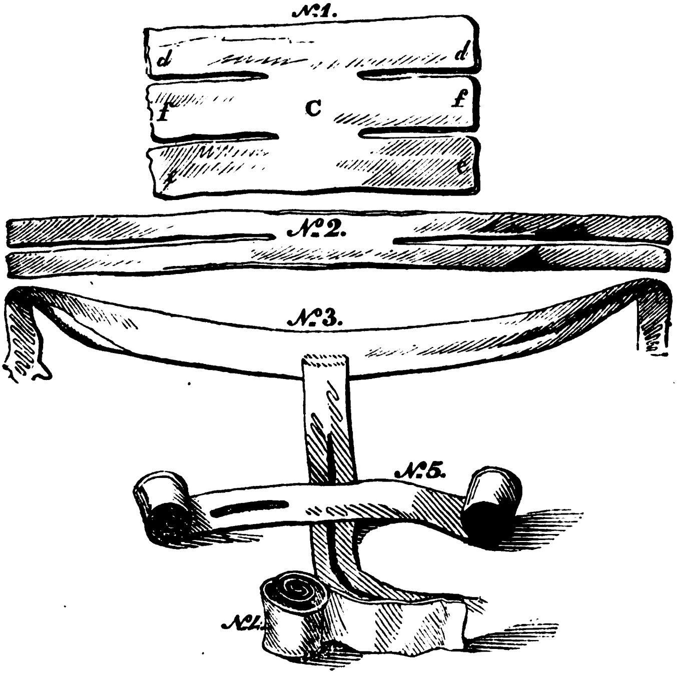
II. If a raw soldier be wounded, who has come from home but lately, who has lived in garrison, and at his ease, who is full of young blood, and has what Sir John Pringle has called the constitution of spring, he also will bear bleeding.

III. You should bleed very freely in wounds of the belly, head, or breast, or great joints; but there is no need of bleeding in a mere flesh wound, where inflammation never runs high; and you should be sparing of the patient's strength in fractured limbs, for though there be inflammation at the first, it is to be succeeded by long confinement, tedious exfoliations of the bones, and a profuse discharge.

IV. If a patient have lain long with gleeting wounds, and a malignant sore, if it bursts out from time to time, and will not heal, it will, too often, be explained to you by the general air of the hospital, or by the habit of the patient's body; but if there be no such cause, you will then renew your search for balls, or pieces of cloth, or splinters of bone.

V. But if you attend closely to the constitution of your patient, and the air in which he lives, you will find in the soldiers who have lain long in your hospitals every mark of weakness; you will find pale and flabby wounds, gleeting sores, exfoliating bones, and stumps that will not heal; you will find, on the other hand, as the causes of these, frequent fevers, hectic, diarrhœa, night-sweats, profuse evacuations from the wounds, which, as Ranby expresses it, "run the patient out of the world;" and in exigencies like these, you will find opium the best remedy for the diarrhœa, wine and spirit of vitriol for the gleeting sores, bark for the febrile paroxysms, and air and cleanliness for the general health. Attributing much of their dangers and sufferings to the tainted air, you will drive all loiterers from about your hospitals, and those who are really ill you will try to send early home; and considering the duty and the feelings which press upon you at such a time, you will risk all patronage for yourself, to procure conveniencies for your soldiers; you will dare to offend, where it is necessary, in a right cause; you will spare neither solicitation nor remonstrances; you will be steady and persevering, but still respectful to those who are over you in command: respectful, not from any fear of your own interest, but from a manly sense of subordination and service, and a sincere desire of gaining your end, which is easily attained by a winning manner, but never by that conduct which is too apt to be felt as rude or mutinous by those who are in command above you.

But, above all things, learn to refrain from after complaints; for at the end of a war they sound too like the murmuring of those who are disappointed of the profits of it, and ill become the character you should endeavour to support.



DISCOURSE IV.

ON BANDAGES.

In my last discourse, Gentlemen, I ventured to say, " That while we are improved in the great points of surgery, we are gone backwards in all those nice and delicate attentions, on which so much depends in the cure of wounds." And while speaking of suppurations and fistulas, and the lax swelling of a wounded or broken limb, you could not but observe that I noticed many uses of bandage which you must have lamented to find so imperfectly explained in books. These things, however, should not be neglected; they are least of all to be neglected by one who thinks an attention to the common and humble duties of the profession more commendable, more becoming, more like good sense and sound judgment, than a passion for bloody operations and extraordinary cures.

With the design of this discourse, you are therefore already in some degree acquainted; and I trust, that I shall prove the subject to be particularly worthy of your attention; for a bandage is not merely useful in tying up a wound, but in accomplishing many important operations in surgery, more interesting, indeed, than those which are done with the knife. In wounds, in abscess, in fistulas, in any general disease of a limb, bandaging is the chief operation of surgery; what the knife cures, it partly destroys—what the bandage cures, it saves.

I. Although in recent wounds, it is with plasters and sutures that we unite the parts point to point, yet it is with the bandage that we support the limb, preserve the parts in continual and perfect contact with each other, and prevent any strain upon the sutures with which the parts are immediately joined, and we often unite parts by the bandage alone. The Uniting Bandage has been long known by that name.

II. Although in the hæmorrhagy of amputation, or in any regular piece of surgery, we trust to the tenaculum and ligature alone, in the hæmorrhagy of wounds we cannot always find the artery; we dare not always cut the parts, for fear of greater dangers; we are often alarmed with bleedings from uncertain vessels, or from members of vessels, or from veins as well as arteries: these are hæmorrhagies to be suppressed by the compress, which compress (or even the sponge itself) is but an instrument of compression, serving to give the bandage its perfect effect. Frequently, in bleedings near the groin, or the armpit, in the angle of the jaw, wherever the bleeding is rapid, the vessels uncertain, the cavity deep, and the blood not to be commanded by a tourniquet, and where the circumstances forbid a deliberate and sure operation, we have recourse to compress and bandage.

A bandage is very powerful in suppressing bleeding. At one period of surgery it took place of every other method; and that was not in times of ignorance, but long after the discovery of the needle—not among unskilful men only, but among the best surgeons in France; or in other words, this was practised very frequently by the best surgeons in the world, not only in the times of good surgery, but by the very men who made surgery what it is. If a compress be neatly put upon the bleeding arteries, if there be a bone to resist the compress, or even if the soft parts be firm below, and the bandage be well rolled, the patient is almost secure. But such a roller must be rolled smoothly from the very extremity of the fingers or toes; the member must be thoroughly supported in all its lower parts, that it may bear the pressure above. It is partial stricture only that does harm, creates intolerable pain and anxiety, or brings on gangrene. Hæmorrhagy requires a very powerful compression, which must therefore be very general, and must be made very skilfully, to be either supportable or safe; it must not be made only over the bleeding arteries, which is all that the surgeon thinks of in general, nor must it be begun at that part where it is particularly required; the bandaging, for example, by which a wounded artery at the bending of the fore-arm may be cured, must be begun at the very tips of the fingers; each individual finger must be rolled; the roller must be continued over the hand, with the greatest attention to leave not a single point unsupported, nor subject to strangulation. It must be rolled carefully and firmly upwards along the fore-arm; and thus the whole of the limb will be supported against that pressure which is made, particularly upon the wounded part. Gangrene is, you may easily perceive, the effect, not of a firm bandage because it is firm, but because it is partial, and strangles some single point of the limb.

When I speak of the firmness of the bandage, I address sensible men. You of course believe it possible to roll a limb so very tightly as to stop the circulation in it altogether. Whenever a roller does not press, the veins become gorged with blood. The blood does not circulate in that part. The surface becomes dark coloured, and in the morning there are vesications on the skin, and in all probability the mischief is consummated—the limb has become mortified. We also perceive how a beggar is able by the help of a roller merely, to waste his limb, and squeeze together the very bones*. We know, that by a compress and bandage thus applied, we can stop a bleeding artery, as was often done by the older surgeons, by laying a compress within the wound.

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* The proof that these villains make their ulcers, and destroy their limbs, by secret methods of their own, is, that no surgeon ever saw such diseases except in beggars; nor is he well able to explain how such diseases, ulcers, distortions, and swellings are produced; he could not, all at once, promise to make those diseases, which they produce with very little suffering. The surgeon himself, though well skilled in his profession, would need to study how to

III. In abscesses, where matter is working downwards along the limb (seeking out, as it were, the weak parts), undermining the skin and wasting it, insulating and surrounding the muscles, and penetrating to the bones, the bandage does every thing *. The expelling bandage, the propelling bandage, the defensive bandage, were among the names which the older surgeons gave to the roller when it was applied for these particular purposes; and these are properties of the roller which should not be forgotten. It is obvious, that of all bandages the simple roller is the best fitted for a diseased limb; but the moment you begin to apply this simple bandage, you will meet with unexpected difficulties: you will feel the necessity of use and practice towards rolling a limb with neatness and perfect effect; you will find yourselves awkward at first, and would almost believe, that a simple roller could never be made a perfect support to a diseased joint; you will perceive your

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swell the joints, waste the bones, blow up the parts, as the scrotum, or knee, or head, with wind, how to produce perpetual ulcers of all horrible forms, how to destroy the limbs by compression, how to produce sore eyes, perpetual vomitings of blood, passing of stones from the urethra, enormous flatulent swellings of the stomach. These, and all kinds of diseases (except serious or distressing ones), beggars know how to produce; and this hereditary craft of the gipsy tribe is not quite unworthy the attention of medical men.

* The ancient surgeons knew more of this than the moderns. In the preface to the treatise of Galen on Bandages, we find the properties of a roller thus enumerated:—“ Efficit enim ut quæ abscesserunt propellantur, hiantia conjungantur, perversia dirigantur atque omnium contraria prestentur.”

bandages to be irregular from the first, and they will be slackened in a few hours. Practice will convince you, that the firmness and neatness of a bandage depend altogether upon these two points, first, upon the turns succeeding each other in a regular proportion; and, secondly, upon making reverses, wherever you find any slackness likely to arise, from the varying form of the limb. Thus, in rolling from the foot to the ancle, leg, and knee, you must take care, first, that the turns, or, as the French call them, *doloires*, of the roller* lie over one another by just one third of the breadth of the bandage; and, secondly, that at every difficult part, as over a joint, you turn the roller in your hand, make an angle, and lay the roller upon the limb with the opposite flat side towards it; you must turn the bandage so as to reverse it, making what the French call a renversée of the roller, at the ancle, at the calf of the leg, at the knee†; wherever, upon making a turn of the roller, you perceive that it will fall slack, you make a reverse of the bandage, and at each reverse you put in a pin to prevent it falling down; you must be careful to roll your bandage from below upwards, and support the whole limb by a general pressure, that you may be able to support the diseased part with a particular pressure; you must lay compresses upon the hollows, and upon the bed of each particular abscess, and change the place of these compresses from time to time, so as now to prevent matter sinking into a particular hollow, now to press it out from a place where it is already lodged, and again to reunite the surface of an abscess already completely formed, from which the matter has been already discharged.

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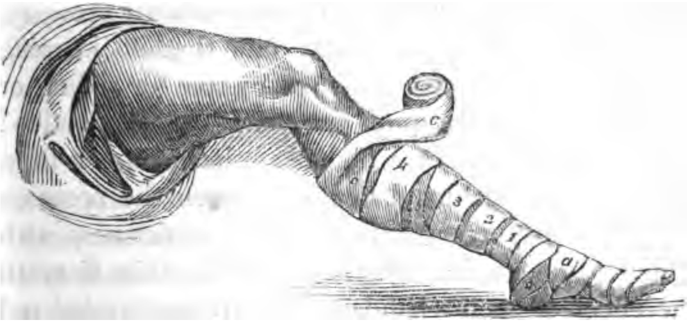
* The *doloires* are marked in the plate in next page, 1, 2, 3.

† Renversées of the roller are marked in the same plate, a, b, c.

IV. In the case of a fistula, or where the abscess has hardened into a callous tube, while you pare away the callous edges, or while you open particular mouths of the fistula with the knife, or dilate them with sponges; while you stimulate the internal surfaces with injections of tincture of cantharides and weak lime water, or a solution of corrosive sublimate in spirits, or stimulant balsams; you must lay such a train of compresses along the course of the fistula as will bring the sides into contact; and when you use a seton, whether it be in fistula, to excite the tube, or in irregular abscess, to lead the matter, and concentrate the disease, you learn by means of the seton the direction of every irregular passage, and hollow tract in the limb, and know, of course, where to lay your train of compresses, and what form to give them.



In a limb undermined with suppurations, in that complication of disorders which I have already described of fistulous or irregular abscesses, or diseased bursæ pouring out their secretions, the roller serves every purpose at once; and in addition to these uses which I have just described, it gradually overcomes the general swelling of the limb; for this swelling is either a leucophlegmatic swelling, which this kind of support dissipates quickly, or it is a low inflammation in which this general support is still more needed: such inflammation proceeds merely from a gorging of the vessels; and stimulating fomentations, camphorated oils, and a well rolled bandage, are the surest cure. This last use of the bandage, viz. of dissipating swelling, and suppressing this low inflammation, I shall be able to set before you, in a strong point of view, by stating one observation which I have often had occasion to make. Surgeons have hitherto complied with a very absurd practice belonging to the old surgery, viz. the rolling and bandaging of a broken limb. The old surgeons meant by their complicated bandages to regulate the form and quantity of the callus; but modern surgeons, who know better things, who have no expectation of affecting the callus by any outward pressure, who have indeed no design but that of keeping the limb straight and quiet, no motive for rolling or bandaging a broken limb, yet continue this practice! The terrible accidents which sometimes happen from imprudent bandaging had indeed been the occasion of endless disputes about the degree of firmness with which a broken limb should be rolled, while in truth the effect of such a bandage is quite uncertain, and is altogether out of the command of the surgeon! The degree of stricture which the bandage will make must always be proportioned, not to his skill, but merely to the accidental swelling of the limb; whether the bandage shall remain nearly slack, or whether it shall be moderately tight, or whether it shall be so strait as to endanger gangrene, must depend altogether upon the degree of that swelling. The country surgeon rolls up a fractured limb, and it is long before he visits his patient a second time; the patient thinks it a duty to bear every uneasiness of his situation, knowing that his leg was bound up by a skilful surgeon; if unhappily the limb swells, and matters be left in this state for two days, it falls into gangrene: but if the surgeon fortunately sees it in twenty-four or thirty-six hours, he is just in time to save it; he finds the bandage very tight, the foot swelled to an enormous degree, the inflammation dark coloured and livid, the leg spotted with gangrene, and studded with small vesicles, and each turn of the roller has left its mark in the limb.— What should be done with such a limb? This accident happens too often for me to be deceived in what should be done. When I find a limb in this condition, swelled by an ill applied roller, if it be already gangrened, a new question arises; if it be recoverable, I cut off the roller, smooth the parts with the hands, roll the limb very carefully and nicely from the very toes, and moisten the bandage with spirits of wine: we must proceed expressly in the same careful manner with a diseased limb, for the swelling is of the same nature. Cutting off the bandage from such a limb as this, and laying it at ease, will but solicit more swelling towards that part, just as laying a diseased limb in poultice will perpetuate the disease: by applying a roller *judiciously*, we prevent the swelling of a member, or recover one that is already swelled.

It is in the complicated case of a swelled and diseased limb that we are sensible of all the uses of a bandage, which is a universal cure for all its disorders. By the bandage we dissipate the leucophlegmatic swelling, abate the inflammation, prevent the extension of matter, lessen suppurating cavities, close the walls of fistulas, procure the reunion of surfaces which have suppurated. The patient is sensible of an easy and pleasant firmness from the bandage, and the limb is actually supported against accidents, and the further extension of the disease. This effect of bandage is observable, not merely in this single case of an ill bandaged limb, but is equally obvious and interesting in other cases; for in varices, though a permanent bandage is usually required, yet sometimes the parts are so strengthened by a roller that they recover their tone. It is also by curing this low inflammation, restoring the tone of the parts, and strengthening their action, that bandage cures ulcer in the leg. If you have seldom seen ulcer even rendered stationary by a bandage, much less cured by it, remember how very ignorantly you have seen such rollers applied. You have seen them drawn round the ulcer, round the shin alone, with the firmness of a tourniquet; the middle of the leg bound very tight, the foot swelled, the ulcer inflamed, the marks of the roller left in large ridges; you have seen it recovering in the morning, only to be tortured into the same condition before night! the limb truly little short of that condition which I have just described in the case of a broken limb imprudently bandaged, livid, swelled, and verging towards gangrene. Instead of this it should be rolled from the very extremities of the toes, and regularly and firmly. It should be rolled in the morning upon rising from bed, in such a manner as to fit it to bear the fatigues of the day; to support and defend the ulcer.

You, I hope, have thought of the anatomy of the saphena veins. The great saphena, you know, sometimes loses the power of its valves; the column of blood being lengthened, presses down on the veins of the leg, ancle, and foot: you see the effect of this in the dark colour of the skin, and the darkness of the granulations of the sore. What should this teach you? But the great saphena may not be the cause of this pressure of blood downwards, stopping the circulation, and consequently weakening the vitality of the part; it may be the lesser saphena, on the back of the leg, which is in fault. Look well to this, and along the vein which is varicose place your line of compresses, while you lay the turns of the bandage over them. This restores the office of the valves of the veins, and relieves the circulation. First, The sore is thoroughly cleansed, its edges smoothed and wrought forwards, and firmly compressed by the drawing of the plaster. Secondly, The limb is rolled from the toes to the sore, then over the sore, and some way upwards, so as to secure the relaxed parts; the bandage so rolled, by a skilful hand, is the only certain cure: neither ointments, nor mercurial preparations, nor sponges, nor leaden plates, will cure an ulcer; it is to be cured only by firm, equable, and perfect compression, which must be renewed more than once a day if the bandage becomes loose. There is no inflammation of the lower extremities in which I do not experience the good effects of rolling. Even mere feeling and vulgar experience instruct a man, when he has an ancle sprained, to bind it firm; and a diseased bursa (as in a relaxation of the knee joint) may be stopped even by so simple a matter as a well rolled bandage. Stimulants, as calomel, opium, and good diet, will keep the system well; and the joint itself may be excited to a healthy action, by pouring hot water on it, by friction with animal oils, camphor, laudanum, &c., and, most of all, by supporting the action thus excited, by a general roller well and carefully applied, and by particular compresses applied upon each bursa. By a compress, merely on each side of the knee joint, when the great capsule of the joint itself was swelled, I have reduced the size of a dropsical knee by the quantity of three or four ounces in a night's time; the fluid being fairly and unequivocally absorbed, without any deception arising from its being pushed into the surrounding cellular substance. I have frequently in a few days reduced prodigious dropsical swellings of the knee, relieved the patient from great pain, restored the use of the limb, and made an absolute and permanent cure. The common sprain of the ancle also is a slighter disease, a temporary one of those bursæ which accompany the peronæi tendons. It seems to be accompanied with very quick and active inflammation; if it be but a little indulged by long fomentation in tepid water, leeches, poultice, and such things as relax the parts, it is rendered a very tedious disease, and the joint becomes swelled and gummy, lame for months, and rheumatic for years, and liable to be easily hurt again by the slightest strain upon it: but if this swelling be opposed vigorously by hot fomentation continued but for a short time, camphorated spirits, a very firm bandage, and long compresses firmly pressed down behind the ancle, and if, after a few days, cold water be poured upon the joint; if it be rubbed, and still firmly bandaged after it seems well, it will be easily cured, and no remaining weakness left to remind us of the accident. Indeed much may be done by compression, which it is no part of my design to mention in this place. I am satisfied with remarking some common and useful facts; which are not to be regarded as trivial, when they serve to establish a general conclusion in your minds: and these general remarks will, I trust, be found important, as furnishing rules of conduct in the daily duties of your profession, and be the more acceptable, as they are not imposed on you with the forbidding formality of aphorisms.

But I have casually mentioned some things, which I would not wish you to conceive that I consider of light importance, especially the application of adhesive straps. You have been already informed, that around an old ulcer a sort of rim or margin forms, firm, elevated, little disposed to change. Unless you remove this by paring it, or touching it with the argentum nitratum or sulphat of copper, and by compression, you certainly will not succeed in healing the ulcer. Now, while the general support is made by means of the bandage or roller, the pressure on the ulcer itself, and the parts immediately around, is best done by the application of adhesive straps. Dress the centre of the ulcer with more stimulating ointments, preserve the new cuticle which is forming around it by mild dressing, as the ceratum plumbi cum creta, and then apply the straps in nice order from below upwards, crossing the ulcer obliquely, and laying them with the regularity of the eighteen tailed bandage. Over the straps you should apply the roller, which consideration brings us back to our subject.

Bandaging a wounded or diseased part is not a mere ceremony, nor is it used only for parade and for the credit of the surgeon, else we should stick to the antique bandages of Galen and Soranus; we should prefer the scapha, or boat-like bandage, the gallia gladiatoris, or bandage like a gladiator's helmet, the regium, or bandage in form of a crown! to any that we now see. Those innumerable forms in which the ancients turned the roller round the head, neck, and body (plainly intended more for parade than use), are to be found in the treatises of Soranus, Glaucus, Diocles, and Galen. In their treatises I find nothing but what has fallen into deserved neglect, nothing that I could mention either for your amusement or instruction. But since those days, the subject has become even more perplexed, no one author has understood another; we have in one book descriptions without drawings; in another, drawings without names; in a third, descriptions, drawings, and names, so confused, that we are apt to lose all the conceptions we have ever formed on the subject. He would be a very active, and, at the same time, a very idle man, who should set himself to disentangle all this confusion for you, and prove by express authority and quotation where the intentions of Soranus, Heliodorus, or Galen, were exactly fulfilled by the descriptions and drawings of modern authors. This is the only occasion in which I would interdict you the study of history! Why should we go back to the ancients in this pitiful manner to learn from Galen or Soranus to tie up a limb? If common sense and ordinary ingenuity, and the knowledge we now have of the higher parts of our profession, cannot support us in so plain a matter as this, we must think very poorly of ourselves; but as Paré observes, I see nothing to persuade me "that nature has lavished all upon the ancients, or that she has quite played the stepmother with us." I hope to make the study of this department in the history of your profession quite unnecessary for you, by explaining to you a short system of bandages; and as I go along I shall endeavour to point out such things in the history of each bandage as it is right that you should be acquainted with.

I have reduced all bandages to those few which are represented at the head of this chapter. It is very true, that if you put a roller merely into the hands of a skilful dresser, he will turn it so curiously round any part of the body, as to ensure every possible purpose; but this he will accomplish best who is most familiar with every other kind of bandage; and there are really certain bandages peculiarly, and, as it were, naturally appropriated to certain parts of the body. The characters and properties of those which I am to describe are as follows.

The linteum scissum, or split cloth, marked No. 1, is peculiarly adapted to the head; it covers the whole scalp, and its legs or split parts tie firmly round the occiput and forehead; it may be made with six or with eight tails, according to the parts you wish to compress*.

The single split cloth, or bandage with four tails, No. 2, which is called the capistrum or stirrup, or the funda or sling, is the proper and peculiar bandage for the face: in cuts of the forehead, or of the face, of the nose, of the lips, in fractures of the jaws, and in every wound which is beyond the circle of the hairy scalp, we use the sling, or double-tailed bandage.

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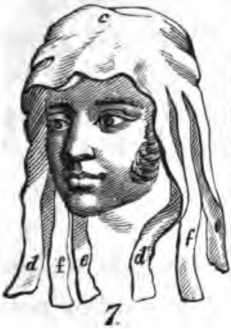
* Marginal plate at the beginning of this chapter.

The T bandage, No. 3, which is named from its resembling the letter T, is the peculiar bandage of the body. If the breast or belly be wounded, we make the circular (a) very broad, which serves as the proper bandage of the body, and we split the tail part (b), and passing one leg over each side of the neck, we pin it to the circular, so that it forms a suspensary for the main bandage, which prevents its slipping down. But if we have a wound, or disease, or operation near the groin or private parts, the tail part becomes then the most important part of the bandage; then the circular is smaller, and goes round the pelvis, while the tail part is made very broad. When the disease is in the private parts, perineum or anus, we often split the tail according to circumstances; but when the disease is in one groin, we generally leave the tail part of the bandage entire and broad.

The roller, No. 4, is the peculiar bandage of the limbs for accomplishing all those objects which I have just explained to you; it serves for the limbs, shoulders, haunches, and occasionally for the body; it is often singularly useful in bandaging the head, where peculiar firmness is required, and there always you are to use the double-headed roller. You take one head of the roller in each hand, and by that which is in your left hand, you fix down the turns of that which is in the right, so that you can make your bandage smoothly firm over the whole head, can knot it at particular points, can turn it in every direction, and fit it to every occasion. Wherever the roller is to be used as a uniting bandage (i. e.) to be applied round any part so that the legs meet and cross each other over a wound (to draw its lips close together), we make a slit in the roller, see No. 5, and pass one of the rolls through it, and thus we make the decussation of the bandage very sure, and give it peculiar effect upon the wound. These are the four bandages which I proceed to describe, and I believe I shall satisfy you that you may throw aside every other.

OF BANDAGES FOR THE HEAD.



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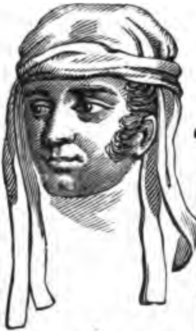

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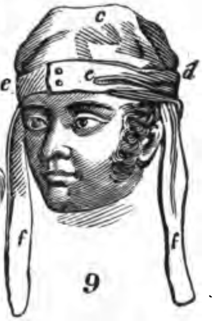

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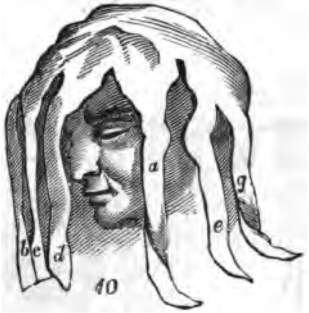
THE head, from its shape, admits with difficulty the application of a bandage; it is more frequently wounded than any other part, and it is wounded very irregularly. When the scalp is generally bruised, or cut in many places, it requires the linteum scissum, or split cloth, which may consist of six or of eight legs; and these are put round the head in various ways.

First, When the cloth has six heads, it is applied as in fig. 7, 8, 9. The middle, or unsplit part of the cloth (vid. c fig. 1, 7. 8, and 9,) is applied to the middle of the head. The two tails (d d) go round the temples, and are pinned at the occiput; the two other tails (e e) go also round the temples, and are pinned over the forehead; the two middle tails (f f) are usually directed to be tied under the chin, but this suffocates and heats the patient; and unless it is necessary for the security of the general bandage, I prefer tying them over the top of the head, or obliquely, in order to press firmly upon any particular point.



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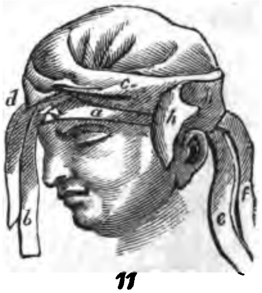

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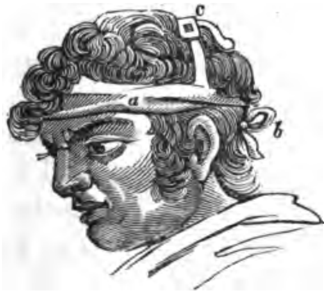
The older surgeons usually split this middle tail into two parts, one broader, and the other narrow; in the broad one they made a hole to let the ear pass through, and tied that broader one under the chin, and the narrower they tied over the head obliquely. Though this gave the split cloth the effect of eight tails, yet they did not name it the split cloth with eight tails. When they split the cloth into eight tails, and especially when they tied the eight tails in the following particular manner, they called the bandage CANCER, as resembling a crab in the number of its legs. The cancer, or split cloth of eight tails, was laid so over the head (vid. fig. 10, and 11,) that four tails hung over the forehead and eyes, and the other four hung over the back of the head; they were tied in the following order:—First, the two outermost tails, before marked (a b), were tied over the forehead, and the tails (c d) left hanging over the knot; then the two outermost tails behind, viz. e and f*, were tied round the occiput; then the middle tails were tied! first c d, the two middle tails before were crossed over each other, carried round the temples, and pinned at the occiput: then g h. The two middle tails behind were crossed over each other, carried round the temples, and pinned over the ears, or near the forehead.

OF THE FOUR TAILED BANDAGE, OR SINGLE SPLIT CLOTH.



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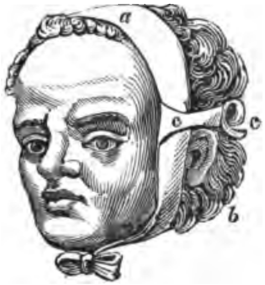

13

The four tailed bandage, or single split cloth, is the peculiar bandage for the forehead, face, and jaws:

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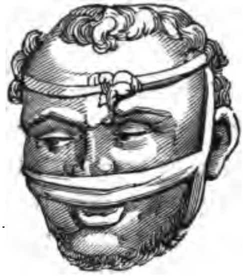
* N. B.—f cannot be seen in fig. 10, because it is on the farther side of the head; but in fig. 11, e f are seen hanging down behind the knot which they form, being tied under the occiput.

if the forehead be the part wounded, this simple and very convenient bandage is applied, as in fig. 12. The bandage is made by taking a strip of cloth not quite so broad as the palm of the hand; it is to be torn or split up at each end so as to leave only a convenient length of the bandage entire, to be applied to the wound: the middle or unsplit part (a) is applied to the forehead, one tail (b) is carried round the back head to meet its fellow; the other tail (c) is carried, as seems best, either upwards over the crown of the head, or downwards so as to tie under the chin.

If the top of the head or sinciput be the part wounded, the bandage may be applied as in fig. 13, laying the unslit part (a) upon the wound, making one tail (b) pass down under the chin, while the other (c) is long enough to go round the head like a fillet so as to secure the bandage from slipping backwards and forwards. It may go round to the occiput only, or it may go round the occiput and return to the forehead, and tie there.

In cuts of the lip or nose, or both, after putting proper stitches in the nostril, lip, &c. we apply the funda or sling, as in fig. 14; we make one small opening to receive the tip of the nose, and we do not forget to make two small holes opposite the two nostrils for breathing. If the nostril or the tip of the nose be much wounded, or almost cut off, after putting in one or two stitches with the needle, we wrap lint neatly round the quills to put into the nostrils. The quills serve for breathing through, and the lint dilates and pads up the nostrils so as to keep the nose in its proper shape, and by distending the nostril it keeps the parts in very nice and equal contact. One tail of this bandage ties at the nape of the neck, the other crosses its fellow at the back of the head, and then turns round to meet it, and to tie on the forehead; and sometimes the lower part also is brought round to tie at the forehead. If the upper lip be cut, and a bandage needed (which seldom is the case), it is almost superfluous to say that this bandage will serve the purpose. It serves also in cuts of the lower lip, though there also we trust rather to hare-lip pins than the bandage; but this bandage is particularly useful in supporting the lower jaw where it is broken. This bandage, when applied thus to support the lower jaw, is named capistrum or bridle (as it goes round the jaws somewhat like a horse's halter). In some cases the circumstances require us to support the chin particularly, and then the unslit part of the bandage is applied upon the chin, with a small hole to receive the point; but where the jaw is broken, we pad up the jaw-bone into its right shape, with compresses pressed in under the jaw, and secured by this bandage. Where we are in fear of hæmorrhagy after any wound or operation near the angle of the jaw, we can give the sling a very remarkable degree of firmness; for this purpose, we tear the band into three tails on each side, we stitch the bandage at the bottom of each split, lest it should give way when drawn firm, and having laid our sponges first into the bleeding parts, and then laid compresses above them, we make the tails of the bandage depart from each other just over the point where the danger is, as in fig. 15, where two tails (a) turn round under the occiput, and are tied there; two others (b) cross each other a little higher, come round by the temples, and tie upon the forehead; and the two other tails may either tie upon the top of the head, or return and tie under the chin. In those cases, strong and firm pressure being required, it is not amiss to have two legs of the bandage long enough to be just twisted at the top of the head and to return and tie under the angle of the jaw with a firm knot. But for purposes like these, viz. of suppressing hæmorrhagy after operations, or supporting a broken jaw, or plugging up a gunshot wound where there is great hæmorrhagy, such as we cannot command with the needle, there is a certain form of the double-headed roller, which I shall presently recommend in preference to this; it is named the knotted bandage.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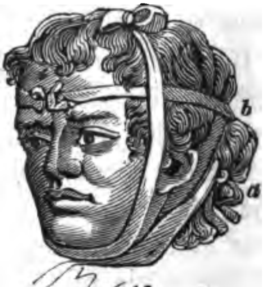


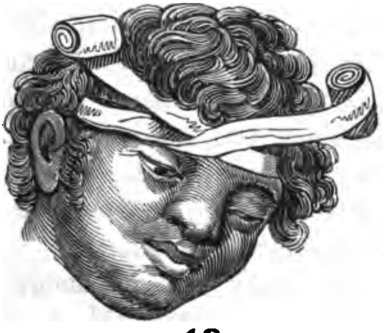
15

OF THE COUVRE-CHEFF, OR KERCHIEF.

These are the peculiar bandages for the head and face. The much celebrated couvre-cheff, or kerchief, I can hardly consider as a bandage; it is no better than a night-cap; it can serve no purpose of compression, whether to unite wounds, or suppress hæmorrhagies, or prevent the spreading of suppurations under the scalp; it serves no other purpose than to keep on the loosest dressings. When you have performed the operation of trepan, and have merely to lay a piece of lint upon the wound, you may use the couvre-cheff, or handkerchief, which is applied in two ways; either in a triangular form, the thick part applied to the forehead, the angle thrown over the head, and the points passing each other on the occiput, and brought forwards and pinned over the forehead, in a manner which is too common to need any drawing.

OF APPLYING THE ROLLER TO THE HEAD AND JAWS.

But the roller is the universal bandage; it supplies occasionally the place of all those which are peculiar to the head or face; is applied to the head in the following manner, first, as a uniting bandage. When the cut is, for example, on the forehead, the two heads of the roller are crossed over the cut, by passing the head at one end, through a noose in the other end; and I find it of infinite advantage to touch either the roller itself, or the skin near the cut, with some adhesive plaster, which gives the roller a firm hold upon the skin, fig. 18, where the roller is supposed to cross over a wound.



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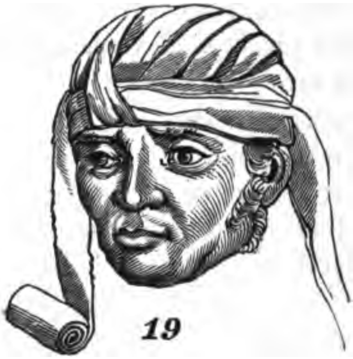
Secondly, In great lacerations, or in extensive suppurations of the scalp, the general pressure which such a case requires may be made by turning the double-headed roller with both hands round the head; and while the right hand surrounds the head with circular turns, the left hand crosses the top of the head at each turn of the roller, and when finished it makes the bandage which is drawn, fig. 19. It is called the capelline bandage, and is the same with that which was a few years ago used for binding up a stump after amputation.



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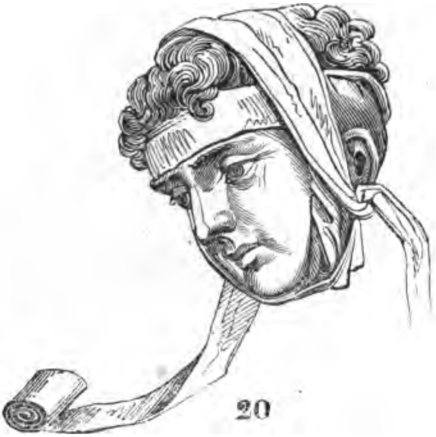
Thirdly, When the jaw is broken, the double-headed roller keeps the parts very firm, and this bandage winds in every direction which the exigencies of the case may require; for whenever you wish to turn the bandage to make it peculiarly firm, you have but to cross the rollers, and change hands. But there is nothing so peculiar in this form of bandage, nor so far differing from the capistrum, or split cloth, as to need a drawing.

Fourthly, In every case of dangerous bleeding from about the jaws, the parotid gland, the ear, &c.

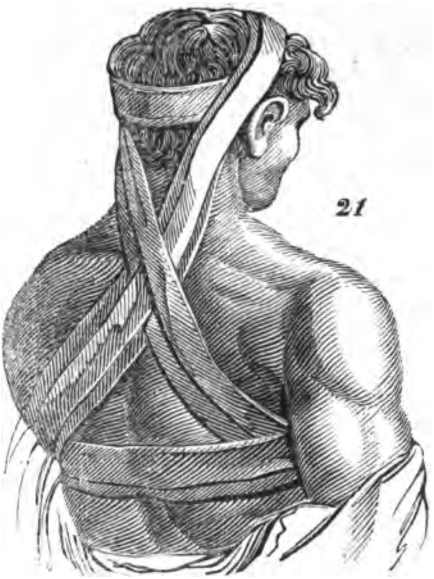
I prefer that form of the double-headed roller which is seen in fig. 20, when at each turn you twist and knot the bandages over the point where the danger is; whence this form of the roller is called particularly the knotted or twisted bandage.



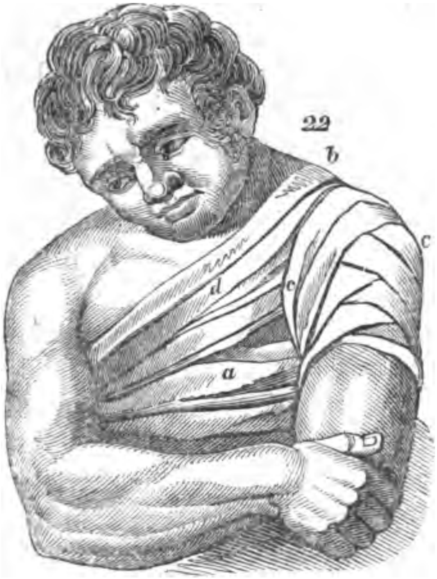
20

BANDAGES FOR THE NECK AND BODY.

Having already described the proper bandage of the limbs, which is indeed but a single roller, I shall proceed to explain to you how that roller is to be turned round the body. The chief difficulties are in approaching the body; I mean, in making the roller turn from the head over the shoulder and back, or from the thigh over the groin; and this must be taught rather by drawings than description. To be plain with you, a bandage cannot be of much use in wounds or diseases of the neck: there we must, in case of wounds, expect reunion from stitches and



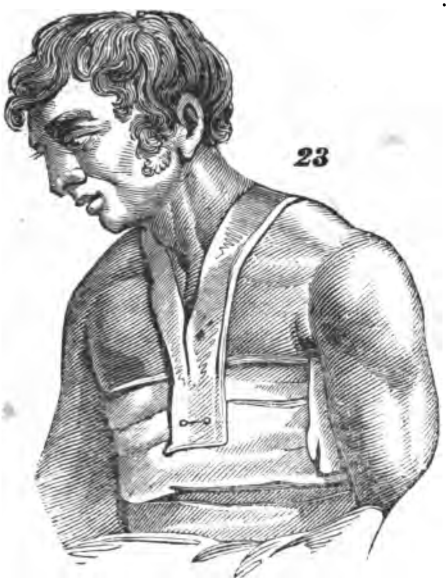
application of adhesive straps; and in fistulas of the neck, we expect a cure rather from setons, and other modes of dressing, than from the compression of a bandage. But the bandage which is generally used I have represented in fig. 21; it is made with a double-headed roller, begins with one turn round the forehead, and then descends by crossings over the neck, then turns round the body, then up again upon the neck; and by thus turning it round the neck, or over it, and crossing in various forms over both neck and shoulders, we can make it tolerably firm. This bandage is useful especially when, after pursuits with horse, many of the infantry are brought in, who have been cut down with wounds of the sabre about the back of the head, the neck, or the shoulders.



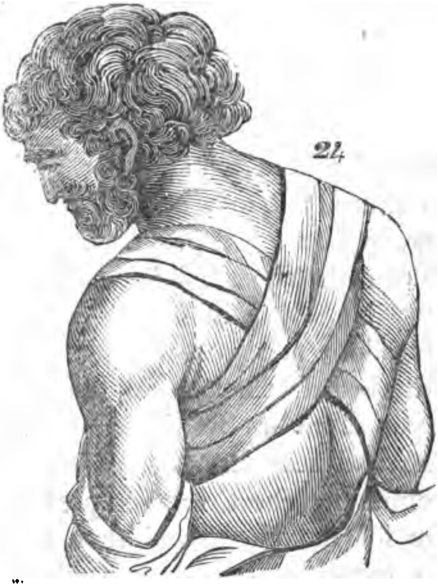
Secondly, The next and greatest difficulty is in approaching the trunk from the arm, and turning the bandage over the shoulder. The best form of bandage is the very old one, represented in fig. 22, named Spica, because, when made, it resembles somewhat an ear of corn. We begin the bandage at (a), by laying the middle of a double-headed roller under the axilla; we carry the two heads first round the body, then obliquely up over the breast and back, and make them cross each other over the shoulder, (b); both heads are then carried round the affected arm at (c c), then up again over the same shoulder, and cross upon the top of the shoulder, and then down again over the breast and back, so as to make a second turn (d) under the sound axilla, and then the roller is returned over the breast and back a second time to the affected shoulder. This spica bandage is sufficiently explained by the drawing; it is often made over both shoulders, and is then called the double spica, being made with equal crossings on the breast and back, and equal crossings upon each shoulder, both over and under it. This bandage is also used in approaching the trunk of the body from the thigh; the bandage is then called spica inguinalis, the spica of the groin, and begins with a turn round the pelvis.

This spica, in various forms, sometimes turning more particularly round the pelvis, and sometimes turning chiefly round the limb, according as the trunk or the limb is most wounded, makes a very firm bandage. In fractures of the clavicle, in wounds about the upper part of the breast, in hæmorrhagies from the mammary arteries at the top of the breast, in fractures near the head of the shoulder bone, in amputations very close to the trunk of the body, we find this bandage, the spica humeri, very useful. The spica inguinis is equally useful in hernias of the groin, in luxations of the thigh bone, in wounds of the upper part of the thigh, or lower part of the belly, in supporting aneurisms of the femoral artery, and in a thousand indescribable cases.

Thirdly, When the thorax is wounded or diseased when the ribs are much broken; when the sternum is carious, with suppuration; when a schirrous breast has been extirpated; when we perform the operation for empyema, (that is, when we make an opening to let out matter confined within the chest); we may use either of these two bandages, the stellated bandage, fig. 24, or the napkin and scapulary, fig. 23. The stellated bandage (so named from the turns of the roller crossing each other in a star-like form) is



the more useful, where a particular and powerful pressure is required: it may be fixed, and prevented from shifting, by putting in pins from point to point, and it signifies little where it begins or where it ends. The drawing, No. 24, will enable you to practise this kind of roller; and you will learn also from it how to fix the broad roller round the chest; for, if at any time you should prefer this simple broad roller to the napkin and scapullary, you have but to turn the roller round the chest, so as to perform its office of a bandage for the chest, and then to give it one or two turns round the shoulder, such as are represented in the drawing, No. 24, so as to give it firmness and security. But, indeed, the more common bandage, fig. 23, the napkin and scapullary, is much easier and pleasanter; so that, except upon particular occasions, I advise you to use it. It is called napkin and scapullary, because in general it is made by taking a table napkin, folded lengthways four or five times; which being put smoothly round the body, and pinned firmly, is suspended by the scapullary, so named from its lying flat over the shoulders. The scapullary part of the bandage is just a slip of linen, split half its length, so that its two legs being laid round the neck, the unsplit part before is pinned to the circular or napkin; and the two legs, being made to cross each other behind, are also pinned to the circular, one on one side, the other on the other side.



The T bandage, belonging to the groin, or private parts, is so continually used, while almost all other bandages are neglected, that it would be as superfluous to explain it, as it is useful to explain the others. I have given no drawing of the T bandage; but, in respect of all the others, I have acquitted myself in my duty towards you, so as to be satisfied in some degree with what I have done. I find, indeed, that I have not entered so much into the history of the old forms of bandage as I once imagined I should need to do, in order to make my own system intelligible. I have first explained fully the uses of each kind of bandage; I have selected for you, from the obscurity of the ancient and the inconsistency and confusion of modern authors, a short intelligible system, in which you will find no discrepancies and perplexities of names, descriptions, and drawings; for, when I had settled upon the system which I was to recommend to you, I put each bandage upon the living body, set the subject before me, and as I described I drew.

I will not tell you, what has been but too often repeated, that the night-cap, waistcoat, and stocking, will at times supersede every other bandage. I must rather remind you, that, as a general doctrine, this is quite opposite to the principles which I have laid down. It is a way of speaking that savours too much of that slovenly practice in which poultices, fomentations, filth, and rottenness, and diseases, go hand in hand. The night-cap, waistcoat, and stocking, supersede no bandage; they are only useful where bandages are not required.

DISCOURSE V.

ON HÆMORRHAGY.

A historical and practical Discourse on the Effects of Hæmorrhagy—the various Means of suppressing Hæmorrhagy—and the Doctrines of modern Authors concerning the Retraction of Arteries.

To expire by successive hæmorrhagies is perhaps the least painful of deaths, and yet it is the most awful. The repeated loss of blood so directly intimates approaching dissolution, and the patient feels his spirit and strength ebbing so perceptibly at each return of hæmorrhagy, that he clings to life. Those of the most resolute mind are overcome with anxiety which they cannot conceal, and look round for some one to delay at least the fatal moment: and the surgeon feels himself so responsible, that with him it is truly an anxious scene. If the bleeding be slow and gradual, from some extensive surface, as from a polypus of the nostrils, from the womb, from the surface of a stump, or from some extensive sore, the surgeon is sent for from hour to hour; he is called during the night; he is made unhappy for weeks; and, after repeated uncontrollable hæmorrhagies, he sees his patient expire. But, if there be a sudden hæmorrhagy from the vessels cut in any operation, or from an aneurism, or from some great wound, the arteries of which cannot be discovered, there is immediate danger of the patient's expiring, even in the surgeon's hands. Let those who have witnessed the agitation of such scenes judge of the importance of that subject which I am now to explain to you; indeed I may appeal directly to yourselves. Is not this fear of hæmorrhagy always uppermost in the mind of the young surgeon? Were this one danger removed, he would go forward in his profession almost without fear.

It is the dashing of the blood from the great arteries, and the fainting of the patient, that hurries our most important operations, and makes all the difference betwixt operating on the living body and dissecting the dead. It is this which unsteadies at times the hands of the boldest surgeon, and makes his heart, at the first alarm, sink within him. No surgeon nor spectator can keep the natural colour of his cheek when a patient is expiring, or in danger of expiring, by loss of blood; and the actual death of a patient must leave a lasting melancholy on the surgeon's mind.

It is really this accident of hæmorrhagy that has retarded the improvement of our profession for ages; for the ancients, ignorant of the ways of stopping hæmorrhagies, did not venture to cut out the most trivial tumor, or they did so with fear and uncertainty. They performed those operations slowly and imperfectly with burning irons or ligatures, which we now perform rapidly and safely with the knife. If they ventured to amputate a member, it was only by cutting, after it was gangrened, among the putrid flesh. They merely separated parts which were already dead and bloodless, so great was their abhorrence of blood.

In slow and in sudden hæmorrhagies the symptoms are very different. In those slow hæmorrhagies which arise from polypi, from smaller aneurisms, from ulcers where the veins and arteries are deeply eroded; in hæmorrhagies from the surfaces of the nostrils, stomach, lungs, or womb; from varices of the lower extremities, or from the hæmorrhoidal veins, the patient is very slowly exhausted. At each return of bleeding the patient faints, and is laid in bed, and the cold applications and the fainting save his life. He rises, after some days, pale, languid, and giddy. The pulse flutters, and is hardly to be felt; the breathing is quick and anxious, accompanied with sighing and great oppression; the heart palpitates on the slightest motion, and the slightest inclination of the head, or rising suddenly from the couch, endangers fainting. The voice is low; the eye is languid, colourless, and of a pearly white, like that of a consumptive person; the flesh feels soft and woolly, and the skin is pale, yellow, gelatinous, and, as it were, transparent, like modelled wax. The complexion of the lip or cheek never returns, even if the person should recover. After this stage of weakness the blood loses its colour; from this time forward it is a bloody serum only that distils from the vessels; dropsy appears; and the slightest loss of blood proves fatal.

But when the patient expires suddenly by an impetuous bleeding from some great artery; when he dies of the bleeding from a femoral aneurism, or amputated limb; when he is wounded among the viscera, and some great vessel is pouring out blood, the symptoms are the same as in that sudden uterine hæmorrhagy which happens in the latter months of pregnancy, in consequence of the placenta being implanted over the orifice of the womb. The blood in the general circulation, in place of being forced onwards by the contractions of the arteries, runs backwards towards the wound from all parts of the body. The arteries no longer push on the contents of the veins; the blood ceases to flow towards the heart; the heart ceases to act; and the countenance assumes, as in asphyxia, a livid hue from want of circulation. The face becomes all at once deadly pale, the circle round the eyes is livid, the lips are black, and the extremities are cold. The patient faints, revives, and faints again; with a low and quivering pulse, he is sick, and his voice is lost. There is an anxious and incessant tossing of the arms, with restlessness, which is the most fatal sign of all. He tosses continually from side to side; his head falls down in the bed; he raises his head at times suddenly, gasping as it were for breath, with inexpressible anxiety; the tossing of the limbs continues; he draws long convulsive sighs; the pulse flutters, and intermits from time to time, and he expires. The countenance is not of a transparent paleness, but of that clayey and leaden colour which the painter represents in assassinations and battles; and this tossing of the limbs, which is commonly represented as the sign of a fatal wound, is indeed so infallible a sign of death, that I have never known any one recover who had fallen into this condition.

Fear and horror lead to superstition; and in stopping hæmorrhagies many superstitions were practised. There was, in the dark ages of the sixteenth and seventeenth centuries, a grotesque mixture of philosophy and magic; the physicians wished to appear philosophers, and to operate by natural powers; and yet their chief confidence was in charms and incantations. Philosophy, such as it was in those days, they trusted to, only, when incantations failed. The iron ore Hematites was so named, because they were persuaded that the very touch of it would suppress bleeding: and Wolffius says, "Cur jaspis tacto vulnere, unde sanguis prorumpit eum sistat nondum novi." The reason of the singular effects of the sympathetic powder, and other charms for stopping hæmorrhagies, they durst not inquire into, but they believed and wondered. They tied live toads behind the ears or under the arm-pits, or to the soles of the feet, or held them in the hand till they grew warm, in order to stop hæmorrhagies. Some imagined that the toads operated by causing fear and horror; but all believed their effects to be very singular; and Michael Mercatus says, that this effect of toads is a truth, which any person, willing to take the trouble, may satisfy himself of, by a very simple experiment; for, "if you hang the toad round a cock's neck for a day or so, you may then cut off his head, and the neck will not bleed a single drop!" Wolffius, and Senertus, and Michael Mercatus, and Hoffman, and Gottfried Mæbius, and many others, do greatly commend the live toad; nor was there any thing that could come in competition with it; since nothing could be imagined more unnatural, absurd, and offensive, unless, indeed, it were the moss which grows in a dead man's skull *. In short, they proceeded from folly to obscenity, and from obscenity to blasphemy, till they came to profane the most sacred things †. Their philosophical doctrine of Derivation and Revulsion was not unworthy of those who believed in these charms. In hæmorrhagy they tried rather to divert the blood than to stop it directly; they applied cupping glasses near the open vessels; put ligatures round the limbs, made strong frictions; or opened a vein in some distant part of the body; they operated from right to left, not diagonally, but according to the direct line of the body. If there was hæmorrhagy from the left side of the neck, they bled in the left ancle, not in the right; and for hæmorr-

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* For suppressing hæmorrhagy, the ancient and learned physicians used an amulet, made out of the right ear of an ass! A hare's fur had long been the favourite application to stop the hæmorrhagy of wounds; but the following notable improvement upon hare's fur is recorded by Ab Heer, Lib. I. Cap. 5. "Pilos e pube muliebri avulsos, inque nares virorum intrusos;—et e pube virili in fœminarum nares immissos." The fascinating verses used by the German surgeons were shockingly blasphemous.

† In those days it was neither styptics, nor medicines of any kind, but the Devil or our Saviour, that did all the good or harm in extraordinary cases.

hages from the right side of the head, they bled in the right foot, ("et de latere dextro capitis ad pedem dextrum, non ad sinistrum," Guido, p. 171). Even down to our own days, tourniquets have been used for like purposes; sometimes to keep in the blood, sometimes to drive it out! In profuse menstruation, tourniquets have been applied round the thighs and arms, to prevent fainting and weakness. And again, in sparing or suppressed menstruation, they have been applied to force the blood through the vessels of the womb! De Goerter asks, not in ridicule, but seriously, "An aligatis parvi articuli aliquid boni prestat in hæmorrhagia?" "I have seen this ligature of the Little Finger, (says Goerter,) practised by an old physician, who assured me, upon his honour, that he had often found it do infinite service, which I firmly believe."

In hæmorrhagy, as in epilespy and convulsions, and other horrible diseases, they trusted more to incantations than to natural means, or they used natural means hardly less superstitious than incantations. None of these was more whimsical, nor more degrading to the regular professors of surgery, than that of cutting up a live hen, and thrusting the bleeding member into it. Would you believe that this method of arresting hæmorrhagy, which had been learned from the hangman, or rather, indeed, from the hangman's wife, was not only mentioned respectfully by so celebrated a person as Platerus, but actually used by him? "A vicious horse having bitten off a man's thumb, and all kinds of things had been used to stop the hæmorrhagy, but in vain, I when called, ordered a chicken to be slit up, and ordered him to thrust his thumb into it, and keep it there while the fowl was hot;—his hæmorrhagy stopped in a moment*."

Such has been the dread of hæmorrhagy in all ages, and such was the philosophy, the religion, the medical skill of all Europe, in the sixteenth and seventeenth centuries; but the ancients, as I have observed, more cruel and daring, had used heated irons, both for stopping hæmorrhagies and for almost all the great operations of surgery. In apoplexy, epilepsy, and palsy; in melancholy and madness; in headaches and hæmicrania, they cauterized upon the coronal suture with burning irons; they measured with the palm of the hand from the root of the nose, and where the midfinger fell they cauterized, not superficially, but down to the very bone, and they burnt through the first table of the bone, and afterwards scraped it so as to force it to exfoliate. This they did after previously purging the brain. In toothache, ophthalmia, and corryza, they burnt in the eye-lid, behind the ear, and in the nape of the neck. In cough, hoarseness, pleurisy; in dropsies, swellings of the spleen, coldness of the liver, or coldness and moisture of the stomach, (quando accident in stomacho frigus et humiditates multæ), they cauterized the belly and thorax. Whatever we perform with the knife, the saw, the caustic, or the needle, they did with cauteries. With the cautery they exfoliated bones; destroyed tumors, as in the antrum maxillare, or gums; dried up ulcers; suppressed fungi; reunited fistulas; cured diseases of the hip-joint, and rheumatism and gout, and curvatures of the spine. It was in consequence of this ancient doctrine that the practice of burning for the gout with moxa was so favourably received in Europe. They cured the piles, and obliterated varicose veins by burning them. They thrust their burning irons through hydroceles and herniary sacs, to obliterate them. The cauterizing iron was praised by Galen* most partially, "velut sceptrum quoddam," as a kind of sceptre with which they subdued hæmorrhages and reigned over diseases; and the provinces which were held in subjection by this fiery sceptre were of no small extent; there was hardly any disease which fire could not cure. The chapters on the use of Cauteries, in the Surgery of Albucasis, are just fifty-eight in number; and the diseases enumerated are leprosy, dropsy, and almost all that the human body is subject to. Albucasis seems to have been in the custom of chastising and chasing all rebellious pains from hip to haunch with this powerful sceptre. He directs how to cauterize every individual part of the body, from the head to the heel, " a capite ad pedes," maintaining his practice by very suitable doctrines.

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* The story of the hen and the hangman's wife, which you have heard of, but never, perhaps, authentically, nor with any proof of its belonging originally to so great a man as Platerus, is literally as follows:

"When I was at Montpelier," says Platerus, "the servant of a certain priest, who knew that he carried all his money, to the amount of good two hundred crowns about him, watched him one night when he was sitting by the fire roasting a partridge; and, while he was twirling it about, came and knocked him down with a billet, and then was at the superfluous trouble of cutting his throat. About a year after, the villain was taken, and condemned to be divided into quarters, for the benefit of the whole city; but, before this, he underwent the following initiating ceremony:—He was carried to the square where he had committed the murder, and there the hangman cut off the right hand with an axe; but, lest he should die of the hæmorrhagy, the hangman's wife, in whose lap the thief sat during all his progress, took a live fowl, which she had provided, cut it up with a knife from the gut to the breast bone, thrust the bleeding stump into it, and tied it firm, and hooped it on with garters like a boxing glove. He was dragged on the hurdle for a whole hour, before he arrived at the spot where he was to finish his career; and, to the admiration of Platerus, who followed him step for step, he lost not one drop of blood!"

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* Galen in Therapeuticis.

At the revival of learning, when the physicians of Europe were as yet little acquainted with natural science, they merely transcribed their lessons in medicine from the Greeks, Romans, and Arabians, and rested entirely upon authority. Then every thing ancient was sacred; they began indeed to find out other cures for ordinary diseases; but hæmorrhagies they opposed only with the heated iron, which was still the sceptrum ad restringendum fluxum sanguinis. The learned of those times were worshippers of fire; and those who seceded from this great doctrine were regarded as heretics, as ignorant men, incapable of understanding the writings of the ancients, or of relishing their doctrines, and were hardly accounted as regular physicians. It was this deference for authority that supported such unnatural and cruel practices; and it was by the learned physicians of France that Paré, the inventor of the needle and ligature, was so hardly used. They considered the hot iron, not as a mere cautery, but as an astringent; and actually believed that they improved the astringent power of their cauteries by heating and quenching them, from time to time, in red wine or strong vinegar. In those days the metal of which cauteries were to be formed, the degree of heat that was to be used, and the very shape of this sceptre, became important disputations. Albucasis had protested against the usage of the ancients and of Avicenna, who made cauteries of gold. Albucasis ordered the cautery to be heated to a white heat, (igneatur in igne donec rubeat et projiciet scintillas), a degree of heat which gold could not so well bear. The more modern surgeons, in searing arteries with the heated iron, could not but observe that too hot an iron made a sudden eschar, which fell off as suddenly; they objected to gold, because it did not indicate the degree of heat, and preferred iron, which marks the degrees of heat by the various colours it assumes. They were thus careful to regulate the degree of heat, because when they applied the cautery too cool to the mouth of an artery, there was no eschar formed, and it continued bleeding; when they applied it too hot, the slough or eschar was apt to yield to the beating of the artery, and to fall off almost as soon as the cautery was withdrawn.

It was in those times that the invention of a new cautery, or a new shape for the iron, was thought meritorious. It was then, also, that Fabricius ab Aquapendente, published his new method (which he claims as peculiarly his own) of cutting off a cancerous breast. "If it be a moveable cancer, I cut it away," says Aquapendente, "with a red hot knife, which sears or burns as it cuts; but if it be a cancer adhering firmly to the thorax, I cut it, without either bleeding or pain, with a wooden or horn knife soaked in aquafortis, with which, having cut through the skin, I then do the rest by digging out the gland with my fingers." These are methods really deserving of the encomium which Mr. Dionis put in the author's name. "They have chiefly the merit," says Dionis, "of hitting two birds with one stone."

"On ferait d'une pierre deux coups*." Guy de Chauliac writes both historically and critically on this very point. The cauterizing irons were of various forms (says he) among the ancients, but the moderns have limited their number. "William of Salicetus has but six or eight forms of the cautery. Henricus has seven only; Lanfranc has ten; but I myself have only six different irons!" a precious employment indeed for Gulielmus de Salicetus, Henricus Lanfranc, and Guido de Cauliaco, counting their burning irons†.

Without reading the books of the old surgeons, it is not possible to imagine the horrors of the cautery, nor how much reason Paré had for upbraiding the surgeons of his own time with their cruelties. A number of cauteries were heated in the fire at once; they were usually of a conical form, so as to enter into the wound, and touch the mouth of the artery, without hurting much of the surrounding flesh; they were brought from another room, for the surgeons were careful to hide this apparatus. They first struck the cautery against the side of the grate, and then rubbed the face of it upon the floor. They clapped the point of the forefinger upon the mouth of the artery, twisted it round and round, and took a second and a third iron, when the first cooled. They turned and whirled the cautery thus round upon the mouth of the artery till the blood stopped; and in deep-lying arteries they pushed strongly upwards, in proportion as they twirled the cautery round, seeking to bury the artery deeper among the flesh. They were careful not to dress the wound till the third or fourth day, lest the eschar should fall off too early. I believe that more dexterity, and certainly more hardihood, was required in performing these operations than in using the needle*. The horrors of the patient, and his ungovernable cries, the hurry of the operator and assistants, the sparkling of the irons, and the hissing of the blood against them, must have made terrible scenes, and surgery must in those days have been a horrid trade.

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* Dionis, page 362.

† These various shapes of the cauteries are to be seen in the chaffer of burning irons at the head of this chapter.

For one wound, and especially for the amputation of a limb, many cauteries were required. Paré, in his spirited reply to Gourmaline, says to him, "If, sir, in a siege, or in the assault of a city, where hundreds of soldiers have their limbs shattered, you should choose to cauterise with burning irons, you would need a page to run backwards and forwards with your irons, and furnaces to heat them in; and I should little wonder, if, in the end, you were to be dragged out and stoned, as happened to Agatheus, one of the earliest surgeons in Rome."

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* "In using the actual cautery, the surgeon should be always furnished, of several sorts, larger and smaller, with button, flat, and pointed extremities, for the better adapting them to the mouths of the vessels, without hurting any adjoining nervous or tendinous part. As to the use of which there may be more judgment required than the younger artist is aware of; for if *perfectly red, or fire hot*, as we call it commonly, hastily applied and instantly removed, it is odds but at the same time the *eschar or crust is pulled off with the iron*, and the patient undergoes the pain to no purpose, the vessel now again bleeding as forcibly as ever. When the same, then, is of a moderately glowing heat, being struck against the grate, or side of the chafing-dish, where the burning charcoal is kindled for that purpose, and rubbed against the floor, let it be *strait clapped up to the mouth of the artery, carrying it, however, sideways to the same, that the blood flowing out against or upon it, may not damp the heat*: at the same time let the end of the cautery be turned two or three times round about against the bleeding part, with expedition; still observing upon each touch, whether the work is done complete, whence you may renew or withdraw wholly your instrument, conveying the same, as it was brought you, handsomely out of your patient's sight, and dress up with lenients, as is required in other ambustions."

"But where the artery, although its impetus be taken off, continues bleeding after this, you may give the eschar a touch more, or the heat decaying and proving insufficient, having a second iron always ready in the fire in another room, or behind your patient, in the chimney of the same; therewith finish what remains, observing the same as in the application of the first."

From actual cauteries it was natural to proceed to use substances which had a similar operation, as caustics, stimulant applications, and hot oil; and as these took place of the heated irons, it was natural to call them potential cauteries; in this rank were many fluids, which had no other effect than as they were hot; even melted sulphur was used, and melted lead, and boiling oil, the temperature of which is equal to melted lead; but the boiling oil of turpentine was the favourite application. Kettles of boiling turpentine were kept in readiness in the cock-pit during a battle at sea, and in hospitals where great operations were to be performed; but their chief potential cautery was blue vitriol, which was applied in the following manner:—The vitriol was pounded grossly (not very small), it was wrapped up in a linen rag; this little bundle, like a waistcoat button, was what they called a button of vitriol; and the blood being for a moment suppressed by the tourniquet, this vitriol button was placed carefully upon the mouth of the wounded artery. The tourniquet was let go, after some interval of time, and very slowly. The exuding of the blood dissolved the vitriol slowly. This caustic affected the artery, made an eschar like that of the actual cautery, which fell off after some days. The same precautions of unscrewing the tourniquet slowly, &c. were used in dressing the wound, which was seldom opened up till the fourth or fifth day.

We are to judge of these cauteries, boiling oils, vitriols, corrosive sublimate, and other caustics*, not by the horrors of the operation, nor the transitory pain of the moment, but by future consequences, for the patient was continually exposed to hæmorrhagy. The eschars might loosen too early, and of this accident, and of the sudden hæmorrhagy which followed, thousands died; while few escaped a dangerous loss of blood, and repeated cauterizing for many successive dressings. In wounds, the bones and tendons were exposed, the muscles wasted, and the arteries themselves sloughed to a great extent, bleeding as long as the patient's blood retained any colour. And in amputations, the flesh was wasted, the bone projected, and the stump was pyramidal and could not be closed. Is there any wonder that the discovery of some styptic or effectual astringent of the vessels was greatly desired? or that the meanest pretender attracted notice? or that those few medicines which suppressed hæmorrhagy, though but in a very imperfect degree, procured for the inventors public rewards?

The transition was natural, from corrosive sublimate, caustics and vitriols, to the milder metallic solutions, which then lost the name of potential cauteries, and were obtruded, in various disguises, under the title of styptics and astringents. The chief styptics have been acids, solutions of vitriol, turpentine, and various solutions of astringent gums in spirits of wine. These were invented by the regular physicians, and had their successes in slighter hæmorrhagies; and always the hope was indulged of finding out some astringent sufficiently powerful to suppress even the bleeding from an amputated limb. This easy and credulous temper of mind in men of our profession has left the public very much exposed to the practices of quacks. We know by long experience, and many disappointments, the insignificancy of those drugs which have been produced from the vegetable or mineral kingdom to serve as styptics; we know them to be of little use farther than to check any slight bleeding of the nose or gums. We no more expect any acid, spirituous, or saline body to act as a styptic without causing pain, than we would expect Digby's sympathetic powder to act at the distance of many leagues. We know that the chief secrets of empyrics have been the neglected inventions of old physicians. We have never heard of any styptic which was not proved in the end to be a solution of vitriol, or a spirituous solution of some astringent gum!—What should we expect from the random inventions of ignorant people, whose sole trade is that of cheating the public, and whose only skill is that of contriving and managing the deceit? From the time of Rewbell to the celebrated Ruspini, we have found disappointment following quick after each fit of expectation; and though many, attracted by the prospect of public rewards, have imposed for a little while—though their styptics have for a day borne an inestimable value, yet always the charm has vanished with the secret. Such styptics have no sooner been bought by the king and parliament, and publicly prepared—they have no sooner been dignified with the high-sounding titles of royal styptics, aqua styptica regalis, &c. &c.—than they have been rejected and despised.

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* We are told in Young's Currus Triumphalis, of nineteen men being cruelly destroyed by using corrosive sublimate for restraining the hæmorrhagy.

Rewbell was a German chemist, and, having gone up to Paris with his styptic, he so wearied the king, and M. Louvais, with entreaties and solicitations, that, after long attendance, he obtained leave to use it upon one of the soldiers in the hospital of invalids. This poor man's leg having been amputated in the usual form, the surgeons and physicians of the hospital delivered him up to Mr. Rewbell, who had hardly finished the first application of this styptic, before the blood came draining through all the dressings. He doubled the dose of his styptic water, dressed his stump firmly a second time, but still the blood flowed*; so that in a little while, and in presence of all the assistants, the unhappy subject of this cruel trial died under his hands. Either they had not had that fear which they should have had for the patient's life, or they wanted humanity or resolution enough to stop this horrid experiment; but they made some amends by procuring an order from the king, prohibiting Rewbell, under the severest penalties, from repeating this attempt.

We have seen the latest of these inventions, Ruspini's styptic, tried in this place, where I believe it is esteemed as of much the same value with the sympathetic powder of that famous knight, and most complete gentleman, Sir Kenelm Digby; which sympathetic powder stanched the blood as effectually, when it was applied to the weapon, as when applied to the wound itself*.

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* This Eau de Rabell, so famous in France and Germany, was just a mixture of strong spirit of vitriol and spirits of wine.

This country has never been behindhand in credulity, nor in public liberality. About sixty years ago, Turner observes, "That among liquids there are blood-stanches of great variety, every empyric now boasting of an infallible styptic."—"In the reign of King Charles the Second, Mr. Denys's Essence made great noise among us, many experiments being tried therewith by Dr. Walter Needham and Mr. Richard Wiseman, as well on brutes as human bodies, several of the court physicians and principal surgeons being present, the king himself also a spectator at some of them, and declaring his satisfaction in the same; upon which Monsieur Denys was desired (but not without a princely reward) to communicate his secret, which was prepared in the Royal Laboratory, and after used with very great applause, under the title of Stypticum Regis; yet quickly after the secret taking air, the same began to be overlooked, and little set by, which put another secret-monger upon publishing one not half so good, as was proved by that faithful and judicious practitioner Mr. Cowper, in the hospital of St.

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* This, I believe, is the same knight whose gallantry and loyalty carried him to such excess, that he burst the arteries of his legs, so as to form aneurisms, by kicking open the doors of the den, in which the boar was confined which the king was to hunt: but whether his aneurisms needed to be opened, or whether he used his sympathetic powder, or whether he applied it to the door, or to his own hams, the German writer who tells this story does not declare.

Thomas, Southwark; who, notwithstanding the differing character given it by the author, declared it a most painful and violent caustic, at the same time ineffectual in the end of its application."

"However, when our people had run a-madding some time after this new lunary, a purchaser was met with (much good may do him with his bargain) on whose hands, I doubt, the commodity goes heavily off, especially since another wonder-working-whim for the same intention is put up to a sale; which, notwithstanding a quondam first rate physician has been fautor thereunto, I must do that justice to the public, to declare, in those few trials I have made therewith, I found it what the people call a chip in pottage; and, I fear, whoever shall lay a stress on the same in amputation, or restraining any forcible hæmorrhage from the arteries of human bodies, especially the adult, will be found to do little better than trifle with men's lives. The first time I had sight of this medicine, and tried it upon my tongue, I was absolutely certain it was a solution of steel, which was farther confirmed by some other trials I made use of*."

Societies for the improvement of natural science had been established in England and France; and it was well known that the discovery of a good styptic was a benefit for which the public would not be ungrateful; and that any invention worthy of the patronage of those societies would ensure the royal bounty.

It was about the end of the year 1750, that Mr.

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* Turner's Surgery, page 338.

Brossard, a surgeon in Berry, went up to Paris with the hopes of selling a remedy, which he said was perfectly effectual in stopping, not only the hæmorrhagy of wounds, but that of an amputated limb. At his request a committee of the Academy of Surgery being appointed, he performed in their presence many experiments upon dogs and other animals. The most perfect successes of this kind could not be considered as decisive, because dogs and lesser animals never die of such bleedings; but they were such as to entitle the academicians to allow of bolder trials. He was allowed to try his remedy in the Hospital of Invalids, where he perfectly succeeded in stopping the hæmorrhagy, after an amputation of the leg; and Mr. Faget having two patients in La Charité, with legs much crushed by a waggon loaded with stones passing over them, he amputated both legs, and in both Mr. Brossard suppressed the bleeding. Both of them died some days after, but not of hæmorrhagy*.

This invention of Mr. Brossard's was the agaric of the oak, a fungus which grows upon the oldest trees; it is gathered in August or September, after the greatest heats; and it is prepared by long keeping in a dry place, by cutting away the outside rind, and beating it till it soften, so that it begins to yield and can be torn with the fingers; it is of the colour and appearance of shamoy leather, and in the country parts of Ireland it is actually called oak leather. It was cut into small pieces, which (the tourniquet being firm screwed) were fixed upon the mouths of the bleeding arteries, were supported by compresses, and bound firm down in the wound, or upon the face of the stump, by a fillet, which was passed up along the limb. It succeeded often in the hands of Messieurs Faget, Bouquot, Morrand, and other great surgeons of Paris.

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* The one died on the fifth, the other on the ninth day. The arteries were so contracted near their mouths, that Mr. Faget could hardly introduce the smallest probe into them, which gives occasion to a very fine dissertation, of no inconsiderable length, upon the power the agaric possesses of causing arteries to contract.

Though the use of the agaric in hæmorrhagies had actually been mentioned by Felix Wurtzius a hundred and fifty years before, yet Mr. Brossard was liberally rewarded by his Most Christian Majesty. Pieces of prepared agaric were sent, with a respectful letter, from the French Academy to our Royal Society; by them it was committed to Mr. Warner, who made various experiments with it, generally successful; and he closes his remarks with this sensible observation, That the agaric is still more useful in old and ulcerating wounds, and in stumps where the rottenness of the flesh prevents the needle being used, than in amputations, or recent wounds. This discovery was thought to be perfect. Mr. Faget, in his enthusiasm, believed that the needle was to be superseded by the agaric; the discovery was in this country also a subject of great exultation. The virtues of the agaric were equally extolled in the French Memoirs and in our Philosophical Transactions; it was reckoned to be not merely a sponge, but an astringent, having very singular properties in contracting the vessels; and one Societarian, suspecting that it might be equally useful in internal hæmorrhages, boiled it, like the German peasant, who, in place of carrying the doctor's prescription to a laboratory, rolled it up and swallowed it*.

Yet in using the agaric, much depended on the manner in which it was supported, on the tourniquet being kept firm till it had adhered, on the tourniquet being slowly let go, on the neat compresses which were held over it, and on the bandages with which the whole was secured. With every precaution it did fail sometimes. Warner, after the flattering reports which he at first gave of it, trusted too much to it in an amputation of the thigh, where it failed—it failed often in the hands of the most able surgeons—it fell at last into disuse—and the least that we can say of this discovery, so hyperbollically praised, and so highly rewarded, is, that had it been invented in the days of Celsus, when they were cutting off limbs, not with the assistance of the tourniquet, but by the gripe (i. e. by assistants grasping the thigh), when they were searing the arteries with their burning irons! it must have been of infinite value, and have saved many lives; but coming as it did in competition with the needle and tenaculum, it must have delayed the general use of the needle, it must have endangered many lives, and was in no respect worthy of the high praises bestowed upon it by the Academy of Surgery, nor of those liberal rewards which the king of France bestowed upon Mr. Brossard. The privilege of rewarding merit is a high one; but I fear that such rewards are rather a general bribe, for the concealing of useful inventions; while an invention, really useful, will always be in the same degree honourable, and, in our profession, will reward itself.

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* The story is told by Densingius. "Dr. Nicholaus Muller, having written a prescription for a country fellow, desired him to divide it into three equal doses, very accurately, and take one every morning in a cup of ale; the poor fellow's head ran on nothing but charms and incantations, and he considered Nicholaus Muller as a being very superior to a mere doctor. In a few days the man returned with a hen's egg in a basket, as an offering to the doctor. Muller now perceiving the extreme simplicity of the fellow, asked him whether he had taken the medicine faithfully. 'Very faithfully,' says the clown, 'I tore it into three pieces, as like one another as pease, and took one every morning fasting; and now, thank God and your honour's goodness, I'm pure well.'"

The sponge, which has been used chiefly by the celebrated Mr. White, is more useful than the agaric: it is like it in its operation, is really of value in practice, not to take the precedency of the tenaculum, but to assist it. The sponge can be very thoroughly dried, it can be compressed into a very small compass, it can take any shape, and may be thrust down, into cavities and narrow wounds, where the needle cannot go; it can be made so hard, and pressed so firm by laying compresses over it, as to have at once the effect of a compress and of a sponge; or rather of a compress having this curious property, that at first it presses moderately, but if one drop of blood escapes, the compress swells by absorbing that blood, still preserves its contact with the bleeding artery, and swells more, and presses harder, exactly in proportion as such pressure is required. This is plainly the effect of a sponge, whether it be nitched in betwixt two bones, to compress an artery which the tenaculum cannot reach; or whether it be laid flat upon an open sore, as after cutting out the breast; or after an amputation done according to the old fashion, where the surgeon used to dress his stump open, and to heap compresses tied with a firm bandage above each piece of agaric or sponge. The agaric, possessing a degree of this property, is of use; even our common lint possesses this quality of absorbing and swelling in a slight degree. But the agaric and sponge are both so excellent in this respect, that even those who are the least inclined to use them must acknowledge that, though the agaric will often fail, it has yet enabled surgeons to perform the greater amputations safely. And the sponge, as is proved by Mr. White's practice, is the only thing that can stand by the side of the ligature to assist it. I am sensible, that by thrusting down a sponge I have saved a patient's life, when I could not have extricated myself by any nicer operation.

I am next to explain to you the discovery of the needle and ligature for stopping arteries, a discovery which has raised Paræus to a rank not inferior to that of Harvey, which nevertheless has been neglected for nearly two hundred years! Shame to successive generations, who have disputed about its merit, who have vilified the author, contemned his invention, and prevented the improvement of their own science. This unwillingness to use the needle proceeded from the jealousy and literary pride of the physicians of those times. Delighted with the absurd learning which they cultivated, and attached to their Greek, Roman, and Arabian masters, they were worshippers of the ancients, and of their doctrine of fire. They were intolerant and revengeful; they claimed to be the legitimate representatives of the old schools; they would rather cauterize arteries, with the ignorant and brutal Albucasis, that Arabian farrier, than tie them with Paré, the first surgeon of Europe, their contemporary.

Paræus was body surgeon to four successive kings of France. His talents for his profession were excellent. He had been diligent in anatomy; he had lived in the Hotel Dieu for three years; and, in the turbulent reign of Henry the Fourth, he was in every scene of danger. He was indefatigable in his profession; he was proud of it; he maintained it against the College of Paris. His high fame descending thus for ages, must make you desirous of knowing the real character of the man; and there is no one point upon which his character turns so much as this single invention; for, of all his improvements, this of tying arteries was that of which he was proudest. He says, with the true enthusiasm of genius, "For the good of mankind, and the improvement and honour of surgery, I was inspired by God with this good thought." And as it was the highest of all his improvements, it was that for which his enemies envied him the most.

The fortune of Paræus was very singular; he was at once the chief surgeon, the counsellor, and the private and familiar friend of four successive kings of France. He attended them in their retirements and looser hours; he followed them in the field, through all the dangers which were in those days part of the duties of a king; and which his writings display to us, with a faithfulness and a minuteness of description which the historian should hardly disdain. He had the good fortune, on one occasion, to save manifestly the life of the king, when his arm had been so hurt in bleeding, that it was three months before Paræus could accomplish the cure. He was a man of such rare abilities, and so much valued by the king, that he alone was saved alive in that horrid massacre of St. Bartholomew's day, which remains an eternal blot upon the French name.

But of all his good fortune, this is the most remarkable, that it was he alone who, by his influence over the king, put a stop to this unparalleled butchery, after it had continued, in all the quarters of Paris, during two days. The horrors of the king after those dreadful days of carnage and most sacrilegious murder, and the familiar and even tender manner of his complaining to Paræus, are told by the Duke de Sully very feelingly; for Sully was himself of the reformed religion, and though yet a child, on the day of the massacre, escaped with difficulty.

"The hour is now come," said the king, "when all France shall be of one religion." "Now, by God's light, sire," replied Paræus, nothing alarmed, "I think you will never forget your promise to me, that there were four things you would not force me to do:—To enter again into my mother's womb;—to go out in the day of battle;—to leave your service;—nor, to go to mass." The king then took him aside, and opened up to him the troubles with which his soul was disquieted. "Ambrose," says he, "I know not how it is with me, but it goes so heavily, that within these three days I am as in a fever; indeed I am ill, in mind and in body; sleeping or waking, the murdered Huguenots are ever before my eyes, with hideous faces, weltering in their blood. Would to God the children and the aged, at least, had been spared!" The order for stopping the massacre, which was proclaimed the following day, was the result of this conversation.

There had long been an open war, about privileges and dignities, betwixt the surgeons and physicians; and that was one cause of settled malignity and discontent. That Paræus, a surgeon merely, should venture to write so large a book on surgery, and should make it, according to the grotesque taste of that age, a good and learned book, was high matter of jealousy and offence, and for this reason was Paræus accused of ignorance in the Latin language, and of hiring young physicians (as if young physicians should be more capable in surgery than old surgeons) to write his books. That Paræus's abilities should have raised him to stations of honour, or made him thus familiar with a race of princes, not too apt to condescend, was a sore grievance to all his enemies, or, which is the same, to all the physicians; but more especially, to such a man and such a physician as Gourmelin, whose taste in learning and in manners, and whose habits of mind, are best explained by the language with which he assaulted Paræus.

"It was then very forward, rash, and presumptuous in a certain person, to venture upon condemning the cauterizing of bleeding vessels, (after cutting off a mortified limb,) a method so highly and continually commended and approved of by all the ancients; teaching, in opposition to that, without any authority, without knowledge, without experience, without good sense, some new method of his own, of tying arteries and veins." And, in the end, he proceeds to call him carnifex, and other names, which it is needless to repeat.

These were persecutions which the College of Paris was not ashamed to avow. They claimed the privilege of licensing books, and ordered this public prosecution of Paræus by their president Gourmelin. They would have suppressed this method of tying arteries, so heterodox did it appear in their eyes, and so entirely opposite to the methods of Galen and

Celsus. They won their cause, but Paré declined the authority of the Parliament; asserted the privilege of his own profession; it was however only by advocating his cause that he succeeded; for he appealed to the court, and it was by a violation of the usual forms that he was enabled to publish his book.

Not satisfied with the licensed atrocities of Gourmelin, whom they had appointed to prosecute Paræus in the courts of justice, the college set upon him another hound of the same pack, one B. Comperat de Carcassone, a pupil of Gourmelin, more malignant, dull, and wicked, if possible, than his master. These physicians pretended to despise Paræus as an ignorant man; and behold this Comperat, Gourmelin, and the very college they belonged to, are remembered only by their invidious persecution of Paræus. They contrived to fasten upon him the most injurious accusations: "He was not contented," says Comperat, "with teaching surgery, but entered also into the highest points of philosophy: yet I will correct myself," says Comperat, "he entered into no such high points of philosophy and medicine; he bought these dissertations of various learned men, and had them translated into Latin, in order to make exhibition of his learning to foreign nations."

Had Paræus composed his cases without the help of physicians, and published his surgical operations and consultations, and all the fruit of his experience, in one small volume, his fame, like that of Hildanus, would have gone down unblemished to the latest posterity. But his observations are scattered through the monstrous folios of those hireling physicians; and yet that salt, so sparingly sprinkled, has preserved the corruptible mass for nearly two hundred years. These learned compilers have made his book, what it is, a system of anatomy, a compendium of surgery; —a dispensary of drugs, chemical and Galenical;—a collection of cases;—and a history of travels and voyages, by sea and by land. By them has the text of Paræus been adorned with the most incredible tales, and the margins of his book with the most uncouth drawings of birds and beasts, and comets, and monsters, and men-monkeys, and women-fishes. Never till then was the monstrous composition which Horace derides actually and unequivocally fulfilled. But all this has nothing to do with the surgery of Paræus; this is the work of the young physicians, the compeers of Comperat and Gourmelin; this is their learning; they have made this book of Paré's a Mare-Crisium*, an ocean of monsters, for such writers as Licetus to take their sport therein.

Paré, familiar as he was with kings and princes, was not to observe the strictest rules of decorum with such antagonists as these.

"You boast, moreover, Mr. Gourmelin, that you will teach me my lessons in surgery, and my operations; but in that, I believe, you are a little mistaken; for my education has been quite after another fashion. I have learned my art, not in my closet; no, nor by hearing the discourses of physicians, (though that, also, I have not despised); but in the Hotel Dieu, where I lived for three years, seeing many diseases, and practising many operations upon the living body; and learning also much of the anatomy upon the dead; and this, I trust, I have given sufficient proofs of in the public schools."—"But I have yet more to boast of; for, being called into the service of the kings of France, I have in my time served four successive kings, and I have followed them in battles, skirmishes, and assaults; sometimes I have been in sieges, and sometimes blocked up with the besieged, curing their wounds."—"And, last of all, I have lived in this great and famous city of Paris many long years, where, thank God, I have been held in some repute, and ranked, at least, equal with my peers; insomuch, that there have been few difficult or famous cures in which my head and hand have not been employed. How, seeing these things, dare such a man as you, who have made surgery no part of your study, talk of teaching me*?"

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* The Mare-Crisium is an imaginary sea in the moon, so named in all the maps of that planet.

Yet Paré was touched with their reproaches; he allowed himself to be misled so far by the doctrines peculiar to those times, as to endeavour to prove, that the principles of his invention, if not the actual practice of tying the blood vessels, was to be found in the writings of the ancients; but, after long and diligent searching among the writings of Galen, Celsus, and Avicenna, he was unable to produce

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* It may not be amiss to insert the following quotation, as a specimen of the manner and language of those times, and I am directed to this passage by a good mark, the Marginal Index, where I find the following sharp taunt, entitled by Paræus, "Belle Similitude," p. 781.

"You remind me, Mr. Gourmaline, of a little scrubby boy, who had come from Lower Brittany to Paris, forsooth, to learn French; and one day the organist of the great church of Notre Dame found him lounging about one of the gates of the palace, and took him to blow the organ. After three years, this little round fat-arsed fellow, (bien fessu et materiel), sensible that he had learned not one word of French, returned to his father; telling him, that now he could speak good French, "and besides, Vather," says he, "I can play upon the organs," (et lui dit quil parla bonne Français et davantage, qu'il scavoit bien jouer des orgues). The father, quite any authorities which could either support his new practice, or injure his fame. It was a discovery which set him higher in surgery than Harvey is in medical science, and it was altogether his own. Had this invention been well received, it must, in the course of two long centuries, have improved surgery very greatly, and saved innumerable lives. It would have rendered many operations practicable which the older surgeons never ventured upon; and have made those operations safe which were not so till of late years.

Paré neglected nothing which could give effect to this important discovery. He tried to demonstrate, that even the ancients would have approved of the practice. He also supported his reasoning by facts; by his amputations, and other operations, and by his successes in the most dangerous wounds. He gave the attestations of many eminent surgeons, and especially of Gulliemeau, who then lived in the house with him as his pupil, and who, in the end, acquired a character worthy of his breeding. Nor can we observe, without surprise, how perfect Paré's operations were even in the infancy of this discovery.

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delighted with such a son, goes straightway to the organist of their great church,—"Do," says the father, "let my son try the organ; for I long to know whether he be such a proficient as he says he is." The organist very obligingly went along with them, and the boy having got into the organ, presently claps himself down by the bellows, with a sort of instinctive jump. "Why, what's this?" says the organist, with great simplicity. "O nothing," says the boy, "only you had best play upon the organ, for I play best upon the bellows." "Now I tell you, Mr. Gourmaline, that you have been all this while playing upon the bellows, while I have been playing upon the keys! it is a vastly easy matter, for a fellow like you, to heeze upon his chair and prattle about it; but performing surgical operations, with the knife in hand, is quite another affair." P. 781.

Paré had three general ways of tying an artery; by passing the needle round the artery, down on one side and up on the other, and so tying in along with it a quantity of flesh; or by drawing the arteries out from the wound, as from the face of a stump, by the artery forceps with a spring handle, which he called Valet a Patin; or by striking the needle above the place of the wound, through the flesh of the limb, down quite to the bone, so as to tie in the great artery of the limb; and along with it much of the flesh.

"If there be a bleeding artery," says Paræus, "in any wound, dress the wound with astringents; but be careful, at the same time, to lay a firm compress over the wound, and settle it well with a bandage, and then lay out the wounded limb in an easy way.

"If this do not serve, clap your finger upon the point of the artery, and wait patiently till a clot be formed.

"If the artery continue to bleed, cut up the wound (if it have been sewed), and pass a needle under the artery, enclosing along with it, in the ligature, much or little flesh, according to the circumstances of the case.

"If the artery have shrunk up among the flesh, cut up the wound and tie the artery higher.

"But should both ends of the artery have been still further retracted, then continue your incision, and cut open the skin freely, still pursuing the artery; but still careful of the very artery that you are pursuing, lest you should cut it a second time.

"In an amputated stump, draw your arteries out with the forceps, tie them neatly with a thread; but if once you miss the artery, or your first thread give way, do not use the forceps any more, but pass a needle, four inches long, into the stump, so as to tie in the artery along with much of the flesh.

"These ligatures we are careful not to withdraw too early; nor must they ever be removed till the granulations of flesh have grown up to protect and strengthen the artery.

"If these operations fail, we must have recourse to caustics, vitriols, or the actual cautery, which make eschars and crusts; and we must be careful to prevent these eschars falling off till the flesh be formed.

"Sometimes, also, the surgeon needs to cut the vessel entirely across, by which its ends, shrinking both ways among the flesh, the flux stops; but always the surest way is, to tie the vessel before cutting it thus across."

This is a system of instructions which is fairly extracted from Paræus's books, without mending the text; and, though this system be now one hundred and fifty years old, it is such, I believe, as the best surgeon at this day in Europe could hardly improve. In correctness of practice, surgeons, from his time, went backwards for many ages. They were afraid to follow the bold surgery of Paræus; monstrous fancies haunted their imaginations: some had real fears, while others were pleased to find arguments of any kind against a practice so opposite to the scholastic doctrines which they had long cherished; they were afraid lest the ligature should give way, and they said it would cut across the artery; it would make the end of the artery mortify; it might be thrown off by the continual beating of the artery; so they stitched up the artery, cross tied, and knotted it, and took all kinds of security. They not only tied one ligature round the artery, but they at the same time transfixed it with a needle, and then twisted together the knots of both ligatures, and then, like children, afraid of what they had done, they feared lest this firm tying of the artery might occasion locked jaw, or universal convulsions; so that on their amputation table was produced nothing smaller than tapes, and their needles, which were three or four inches long, were carried round each artery at the distance of an inch, and sometimes through the whole thickness of the limb. It is only after much experience, and by very slow degrees, that we have learnt, at last, that the drawing out an artery, with the forceps or tenaculum, and the tying it fairly with a small ligature, the method which appeared to the older surgeons to have every fault, is absolutely the most secure.

OF COMPRESSION.

We must not wonder, that the surgeons of those ignorant ages, schooled as they were by the physicians *, and under the dominion of a false learning, rejected this improvement; for the last struggle against it was made by the most celebrated surgeon of modern Europe, Mr. Petit.

You must observe, that neither styptics, nor cautery, nor vitriol buttons, nor agaric, nor any other means of suppressing hæmorrhagy, ever was used alone.

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* Even so lately as the year 1738, Hoffman, in his Medicus Politicus sive regulæ prudentiæ, says, "Medicus nimiam familiaritatem cum Chirurgo non ineat—in cura Herniarum ne castrentur viri impediat Medicus.—Examinet instrumenta Chirurgica, visitet emplastra unguenta," &c.

The agaric and vitriol buttons were always reinforced by compress and bandage; the eschars of cauteries were supported by those graduated compresses; nor did the surgeon ever trust entirely to the ligature itself, but supported the vessels with compresses and bandage, even when the needle was used; often he crammed a wound with astringent powders and hare's fur, supported these first dressings with a compress, and kept the tourniquet skrewed with a dangerous and painful degree of firmness round the limb. The great abilities of Mr. Petit, the period at which he lived (when surgery began to be a free branch of science); the irregularity of the practice in regard to wounded arteries; and, above all, the aversion to the use of the needle, and the fear of convulsions, gave to his speculations very particular importance. He preferred compression to all other means of suppressing hæmorrhagy, and believed that bleeding was stopped, not by the obliteration or retraction of vessels, but by the formation of clots.

Mr. Petit believed, that every bleeding artery was stopped merely by the coagulum which formed in the mouth of it: that all means of arresting hæmorrhagy were useful only in proportion as they formed solid coagula: that the coagulum varied in its shape according to the means by which it was produced; and the security he thought more or less perfect, according to the shape of the coagulum. Astringents formed clots by coagulating the blood. Sponges, bovista, and scraped lint, formed clots by absorbing the moisture; compresses made firmer clots, by shutting, and sometimes doubling down the mouths of the arteries; allowing time for the firm coagulation of the blood. Even the tying of arteries he thought more secure, in consequence of the peculiar form of the clot formed within the artery; and when (as sometimes happens) there was a slight bleeding, upon pulling away the ligature, he ascribed that to the conical form of the clot, and to the blood gliding by the side of it. When there was a more dangerous bleeding upon pulling away the ligature, he imagined it to proceed from the clot slipping forwards in the artery, and being at last entirely expelled from it. In a tied artery, says Petit, we observe the clot to be of a conical form. In an artery, which has been stopped by compression, we find the mouth of the artery quite flattened, and the clot of the shape of the reed of a hautboy; but in arteries stopped by lint, or astringents, we have a clot formed, partly by the contraction of the mouth of the artery, partly by the effect of the dressings; in which case the clot is formed, half without the artery and half within; the flattened part of the clot within the artery serving as a sort of plug, while the part that is without lies over the mouth of the artery like a cap or cover, and this part is so connected with the clot within, and at the same time so adheres to the dressings without, that the rude or early removal of the dressings pulls it away.

This is the whole of Petit's doctrine, which is triflingly ingenious, dangerous in practice, unworthy in all respects of so great a man; yet such hold had it got upon his mind, that he wrote upon it, as if his fame had been to rest upon this discovery alone; and for the sake of this doctrine he published the most daring facts, and persevered in the most dangerous practices. The Royal Societies of England and France were the organs by which the learned of those days were connected with the public, and formed a natural connexion betwixt the two countries. The philosophers, but particularly the physicians, of both countries, were impatient to have their trifling papers introduced into these journals. Mr. Petit having set himself to dissect for clots in aneurisms, and in those who died after amputation, easily found proofs sufficient for his purpose; among the chief of which was a large and solid clot, about three inches long, which he found in the femoral artery of a man who died on the fifth day after amputation of the thigh, which artery was presented to the Royal Academy of Sciences in great pomp. Perhaps it would be easy to show that the great academy of the great monarch, Louis Quatorze, was easily satisfied in presents of this nature. But why should we contradict the fact, since the proving that such clots exist does not establish this dangerous doctrine? The artery is not closed by the clot of blood, but the clot of blood is formed in consequence of the closing of the artery. How, indeed, can we suppose any artery to be closed by a ligature without the blood stagnating behind it? or the arteries of a gangrenous limb to lie quiescent and inactive for days without the blood coagulating in them? White and Hunter have found coagula of blood in aneurisms, in the arteries of amputated stumps, and in the arteries of a gangrened limb; but we have, on the other hand, many dissections where no such coagula had formed. The coagulation of the blood then is a mere accident; and Mr. Pouteau undertook a work of supererogation, when he set himself seriously to prove that hæmorrhagy is often stopped without such clots being formed.

Yet this miserable theory, like a sickly child, became every day dearer to Mr. Petit; and he never thought he could do enough to protect and strengthen it. In the year 1732, he entered upon a long suit of experiments, in order to ascertain the power of the several absorbents and astringents, and to make a scale of them: "Astringents, and such substances as usually are employed for stanching the blood of wounds, surely must do so," says Mr. Petit, "chiefly by absorbing that humidity which lies between the vessels and the flesh." Petit made all his astringent absorbents, that they might drink up the thinner parts of the blood, and so help to form for him good, stiff, solid clots. He put lumps of mutton into tea-cups, with a reasonable proportion of the following astringents; first of common bole, then of terra sigillata, which is a finer earth or bole, then of Paris plaster, then of slacked lime, then of various astringent gums, then of gum arabic, then of vitriol, then of salt, then of sugar; and, last of all, of cobwebs; and observed, with most curious precision, the exact degree in which each of these foolish things contracted, or hardened the lumps of mutton; which experiments are still extant in excellent French, in the Acts of the Academy of Sciences for the year 1732; a perfect burlesque upon such experiments, and such subjects. Towards the end of this most philosophical paper, Mr. Petit inserts this wise caution, which completes the joke:—"But all these astringents must of course absorb more humidity, and act in a more lively and perfect manner in the living body, whose parts are always warm, and always ready to put themselves in motion by the force of the animal spirits, which are continually flowing."

There is not, even in the Annals of our Royal Society, any thing to be compared with this. There were, indeed, some experiments made in this country upon astringents, of pretty nearly the same rank with those of Mr. Petit. I mean the experiments of Mr. Young of Plymouth, published in his far-famed book, the Currus Triumphalis, ex Terebinthino, a eulogium on the virtues of boiling turpentine as an astringent. He observed, that turpentine, spread upon a deal board, became quickly dry; that painters used it in mixing their colours, to make them dry suddenly; and he found, upon dipping his finger, first, into reeking blood, and then into hot oil of turpentine, that it begat a sensible straitness," &c.

But I should want all apology for this long account of Petit, and of his doctrine, if it were not that it is a dangerous doctrine, and had absolutely led Petit himself into great mistakes. He persuaded himself that the ligature was hardly more secure than any common means of suppressing bleeding; that it was only in so far useful, as it ensured a firm and conical clot; that, if the ligature fell off before this clot was fully formed, and perfect in its office, the artery would bleed. He therefore preferred the use of a compress to that of a ligature, even in securing the arteries of a great stump. And we find him boasting that, though this method, viz. of compression, is the oldest of all, he will give to it all the effects of novelty; "and since compression is the most natural way, and the very means which should have presented itself, first of all, to the imagination of the surgeon, I will restore it," says Petit, "and set it up above all other means, as cauteries, astringents, sponges, or even the ligature." There is not one of all these, says Petit, that is sufficient of itself; we must use the compress to assist even the ligature.

Experiments, of the philosophical and speculative kind, we can endure, but experiments on the human body are not so easily vindicated. Mr. Petit maintained, not only theoretically but practically, that compression was the surest means of suppressing hæmorrhagy. "The art," says he, "of stopping hæmorrhagy by compression, consists less in the force that is used than in the steadiness with which it is applied. The slight pressure of the finger alone is sufficient, if but the stump and the finger could be kept steady; nor is any thing required to make compression perfectly successful, but to invent a machine which shall perform the office of such a finger. Such a machine did Mr. Petit invent. It was a complicated tourniquet, consisting of one circular, which compressed the artery in the groin, and of two parallel plates of iron, which were moved by a central screw, and compressed the flat face of the stump. To vindicate this strange invention, he delivers a case of an ossified femoral artery, which, after amputation of the thigh, stood out with open mouth, and was not affected, even in the slightest degree, by the firmest drawing of the ligature. Strange case! since nothing of the kind had been ever heard of before; nor has any thing like it occurred since, though amputation is our daily work.

Thus we perceive to what extremities Petit was driven to support his doctrine; and his aversion from the needle, and his perseverance in using compression, are strongly marked by the following fact:—"A nobleman, of the first rank in France, and in whose fate the whole kingdom took an interest, having been wounded in the thigh-bone with a musket-ball, lingered, in a very miserable condition, for nineteen years; at the end of which time the surgeon discovered, and extracted, by incisions, some fragments of bone and some pieces of iron, (especially the ball of a scrutoire key), and along with them some rags of his breeches; but, his strength being quite exhausted, they were forced to amputate his thigh.

"This gentleman, some days after the operation, very imprudently raising himself suddenly in bed, without help, the femoral artery burst out; and, such was the aversion of Petit from using the needle a second time, or the cautery, or vitriol button, or any thing but his favourite compression, that he appointed four young surgeons to watch with him, two and two, night and day, pressing upon the face of the stump." The modern surgeon would, in such a case, cut down upon the fore part of the thigh, and take up the femoral artery.

Compression was much practised in those days; the authority of Petit revived it just at the time that surgeons began to be familiar with the needle, and to lose their apprehensions of spasms and convulsions. To have young surgeons and assistants sitting upon the side of the bed for days, keeping in the blood, was no unusual thing. All surgeons practised this method, but none of the old surgeons perhaps ever fell upon so ingenious and good humoured a device as Ruinhuisen. He had a patient who, from a venereal ulcer on the back of the glans, had a very dangerous bleeding, which no styptics could subdue. He set down two tailors to compress it with their thumbs: "Duo alternatim sartores tanquam vitæ sedentariæ adsueti;" and he might have added, "ob strenuos indomabiles digitos*. The manner of stopping such a bleeding is, to pass a fine sewing needle across the bleeding pore, and then to cast a thread over the needle, and so draw it, letting the needle remain until next day.

Thus did Mr. Petit first suggest to surgeons the importance of examining the state of the artery after unsuccessful operations; and surely while the line of conduct, in regard to hæmorrhagies, remained undetermined, no speculation could be more interesting. After Mr. Petit came Morand, who acknowledged the doctrine of Petit in its utmost latitude: he makes it indeed the basis of his own: he does no more than add his own little bit of a reason for the formation of clots. "No doubt," says he, "Petit has explained very well how the clots stop hæmorrhagy; but these clots surely will be the firmer, if they are helped somewhat by contraction of the artery." His idea of the state of the artery, which assisted in forming, or in supporting, the clot, was miserably confused: it was neither that contraction of diameter in the artery which Kirkland, White, and other English surgeons, have supposed; nor that retraction of the artery among the surrounding flesh which has been so much insisted upon by Pouteau and other respectable writers, but an equivocal generation betwixt those two ideas floated in Mr. Morand's brain. Through the whole of his laborious paper, he expresses his confused idea by the word "crisping up of the artery," par la crispation du tuyau; and he can tell no more of the process than that this cabbaging of the artery assists the clot. In short, he subscribed to the doctrine of Mr. Petit, but could not refrain from adding something of his own; and I believe I have done justice to the idea of Mr. Morand, in supposing that he imagined a curling back of the mouth of the artery, a sort of intus-susceptio, such a straitening of the tube as was favourable to the formation of a clot.

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* This was no uncommon thing, and was a strong proof how imperfect all these methods of suppressing hæmorrhagy were. Mr. Turner says, "And here I can assure you that, in a desperate hæmorrhage of the like kind, I have had this post myself for six hours successively, retaining an emplastic, shifting my fingers as they were cramped, and taking my repast at the patient's bed-side, not suffering a drop of blood to be lost for that time, although a cough attending gave us fearful apprehensions, as well as an unruly patient we had to increase them. Upon removing my finger, the dressings being dry, and sticking close, I gave a charge to two others, hired to sit up all night, and take their turns, how to perform the same task; but, whether through remissness or inadvertency, upon a violent fit of coughing, beyond the reach of a full dose of an opiate I had given him, before I took my leave, to alleviate the same; notwithstanding their endeavours, who, in the surprise, I suppose, mistook the place of compression, the artery burst out afresh, and the patient, living out of town, was exhausted before I or any other help could come to assist him."

Next came Mr. Pouteau, a bolder speculator, who at once rejected the doctrine of Petit, and attributed the stopping of hæmorrhagy altogether to the condition of the artery, not at all to the coagulation of the blood.

"I have dissected a femoral artery," says Mr. Pouteau, "three weeks after it had been tied in amputation; but in it I found nothing of Mr. Petit's clot; nothing to close or compress the artery, except merely the thickening of the surrounding cellular substance, for the ligature was loose about the artery; the canal of the artery was conical, for it grew narrow nearer to the ligature. Immediately under the ligature it was not obliterated, but was much straitened:

It was only below the ligature that it was entirely straitened, ending in a blind sac." This straitening of the arterial tube was accompanied, or rather, according to Mr. Pouteau, was caused by a thickening of the surrounding flesh; for the flesh, he observed, which surrounded the straitened part of the artery was a good deal gorged and swelled, that which lay immediately under the ligature was in a state of gangrene; the flesh again, which adhered about the mouth of the artery, where it ended in the blind sac, was of a cartilaginous hardness, and much swelled. It was Mr. Pouteau's opinion, that the swelling of the surrounding cellular substance compressed the artery, and stopped the blood.

This, then, being the doctrine of Mr. Pouteau, his practice follows his doctrine reasonably well; "for," says Mr. Pouteau, "let it be once proved that it is the swelling merely of the parts surrounding the artery that prevents the blood flowing out, and it follows of course, that the greater the bundle of flesh that is accumulated round the artery, the more of the parts you include in your ligature, the greater the swelling must be, and the resistance to the eruption of the blood must be proportionably great*."

The doctrine of Mr. Pouteau seemed to be, at least, harmless. It seemed, indeed, to inculcate the safest practice of all, viz. that of tying arteries with the needle firmly. But here we see the villany of false doctrines, which lead us unawares into such practices, as, in our cooler moments, we cannot but remember with regret. This doctrine requires that the operator should tie in all the surrounding parts; and Mr. Pouteau made no scruple, under this ample title of all the parts, to comprehend the great nerves also. He regarded the tying in of the nerve as a security to the artery, or rather, I fear, he considered this cruelty as a security to his doctrine. He proceeds to represent the tying in of the Radial Nerve in aneurism of the arm as nearly harmless, and the tying in the nerves, along with the arteries of an amputated limb, as quite so. Thus an opinion, which the world imagines to be the pure result of experience, and receives as an independent and absolute fact, is a mere appendage to a trivial doctrine; and this affirmation, that it is safe to tie in nerves, although it comes from a practical surgeon, deserves no more notice than if it had come from a Spallanzani, or Fontana: yet has it been implicitly received, the doctrine has made already an alarming progress. At first, surgeons were apprehensive of nothing so much as spasms and convulsions, from the tying or injuring of nerves; but now, in the other extremity, they are come to sport with their patients' feelings; and Kirkland, a surgeon justly celebrated for his good sense and conscientious attention to the practice and improvement of his profession, says, in one part, "May not the pain, upon tying a nerve, as it is smart and of short duration only, somewhat in the manner of volatiles applied to the nose, rather enliven the spirits than bring on convulsions*?" This is enough to cure any sensible man of any inclination he may have indulged for those who blend theory and facts in this strange fashion, who compare the smart pain, or rather, as I would term it, the shock and terrible violence of tying a nerve with so slight a matter as the snuffing hartshorn up the nose. Let any man, who will talk to me on this point, first demonstrate that the tying in of nerves will do good, before I close with him upon the secondary question, whether it may not do harm.

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* "Mais, s'il est une fois avéré, que le gonflement des parties au-dessous de la ligature, fait le principal obstacle à l'irruption du sang arteriel, il sera naturel de conclure, que plus ce gonflement sera considerable, et plus il opposera de resistance à l'impetuosité du sang arteriel.

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* Kirkland, p. 22.

[The tying of a considerable nerve along with the artery is attended with great distress. When the ligature becomes a little loose, still it hangs by the extremity of the nerve, and every tug gives excessive pain. Moreover, the noose of the ligature being loose, the nerve lives and inflames, and a bulbous extremity is formed, like a button. So that, after much distress, the patient has to submit to a dissection being made into the wound on the face of the stump, and to have the noose cut. But even if this should not happen, yet if the nerve adhere to the cicatrix, no man can express the miserable consequences to the patient*.]

But when I disapprove of the tying in of the nerve, it is not the pain and convulsions merely that I fear; considering the nerves but as dead parts, these consequences will never fail to ensue; the nerves are peculiarly firm and unyielding in their nature, they undergo their changes very slowly, they do not fade under the ligature as the artery does, nor yield when we would pull the ligature away; the ligature keeps its hold upon the nerve, remains firm, and, acting as a foreign body, prevents the adhesion of the surfaces of the stump, or of any smaller wound: the irritation often produces erysipelatous inflammations, and in the end we are obliged to pull such ligature away, or cut it off from the nerve, not without violence and danger. I have seen ill consequences arise from the tying in of nerves in aneurism, both of the thigh and of the arm, which at present I would not choose to explain. Indeed, in this very dissection of the femoral artery, by Mr. Pouteau, we find that, three weeks after amputation, the ligature stuck firm in the stump, which could not have happened otherwise than from his imprudent practice of tying in, along with the great artery, much of the surrounding flesh, and the anterior crural nerve; and thus his doctrine also leads to incorrect and dangerous practice.

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* Observation by Mr. C. Bell.

Secondly, I would observe that Mr. Pouteau has contrived to support his doctrine, by explaining only half the truth: he has not given a fair representation of the condition of a tied artery: he represents to us a great arterial trunk, tied coarsely with the needle, with much flesh and cellular substance tied in along with the artery, and so takes the opportunity of insinuating his doctrine, by saying, "There was in this dissection much cellular substance thickened above the ligature, and there was a like thickening of the cellular substance below; the mouth of the artery was closed, but that part of the canal which lay immediately under the ligature was not obliterated." In the present day we use the tenaculum; the artery is drawn far out from the surrounding flesh; we tie the artery alone, and the nerve is not included; there is no cellular substance round the artery to swell and close the mouth of it.

[Here I may notice a practice, into which my

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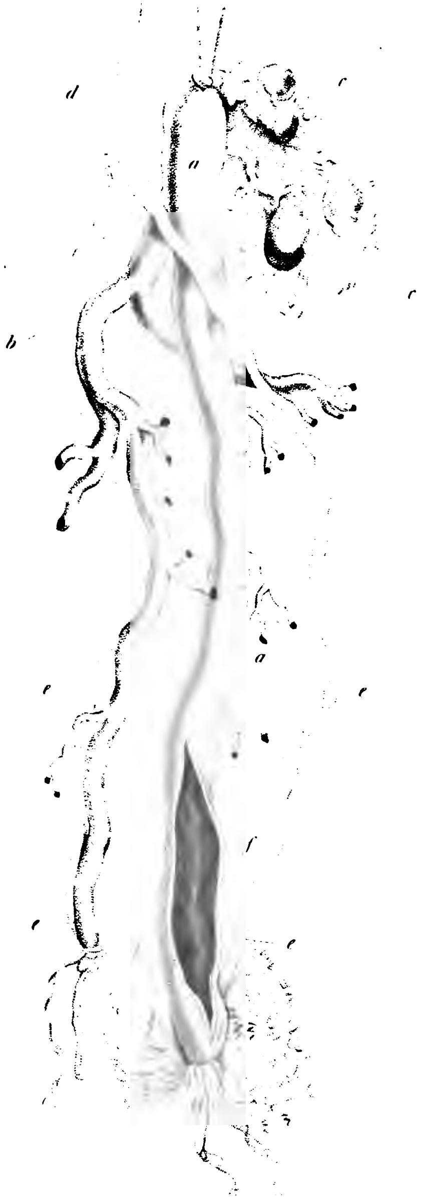

ral Artery.

unda.

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ner Crural Nerve.

of Blood above the Ligature.

ee. The two chief branches
of the Crural nerve
tied with the Femoral
and Profunda.

by J.Bell.

Engraved by J. Stewart.

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brother fell *, of cutting off these ligatures in the small arteries, after the extirpation of tumors, &c. A colleague of mine in the Middlesex Hospital used catgut ligatures, and cut them off short. Mr. Lawrence has advocated this practice with much ingenuity. But the advantages are not very apparent, and the danger considerable. Hard knots are left, including the knots of the ligatures, which give pain, and sometimes they come out by tedious suppuration. Let us consider how often the end of a nerve is included in the ligature; let us suppose that we had committed this error, and had cut off the ends of the ligature, and the noose was buried in the granulations, or the integuments closed and healed: what regrets we should have in witnessing the continued agony of the patient! for no state is more deplorable than that of a man who has suffered amputation, and the nerve is engaged in a hard knot, even of condensed cellular texture, or in the cicatrix.]

Amidst this confusion of opinions, there was engendered here, in England, a new doctrine of the contraction of arteries; and you will observe, that there is a distinct connexion among all these theories, and a very natural progression of ideas, from the crisping of the artery, which Mr. Morand supposed, to that contraction of the artery which has been observed by the English surgeons; a doctrine which they have been at infinite pains to establish, but which carries nothing with it imposing, except the names of White, Kirkland, and Dr. Aitken, who were the chief supporters of it. If these gentlemen had affirmed that the retraction of arteries among the cellular substance was the accident which prevented great

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* Observation by Mr. C. Bell.

loss of blood, the theory might have led to very interesting conclusions; but their theory was quite different. They imagined that, when the artery was cut, its mouth gradually contracted, its diameter being abridged, and the stream of blood diminishing every moment, till it entirely stopped by the mere contraction of the artery. Their doctrine went still farther; they ascribed even the obliteration of the higher parts of the artery (i. e. from its mouth up to the last branch) to this contraction of its coats.—"I am now convinced," says Mr. White, "in opposition to the doctrine of Pouteau, which once seemed more probable, that, according to the supposition of Mr. Gooch, since confirmed by my ingenious friend Mr. Kirkland, the arteries, by their natural contraction, coalesce as far as their first ramifications *." And Mr. Kirkland says, "that nature suppresses the hæmorrhagies from divided arteries, by the natural contraction of their muscular fibres †." And Mr. Aitken of Warrington adds, "that the obliteration of the sac, in the extremity of the artery, is caused by its natural contraction ‡." We have but too much reason to be jealous of any doctrine which might beget an indifference to the securing of arteries by ligature; and should we revive this doctrine of the contraction of arteries, then we should be inclined

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* Page 171. † Page 10.

‡ Vide Mr. Aitken's Pamphlet, page 193. These gentlemen have been at great pains to establish their doctrine of the contraction of an artery on principles and facts. The only facts are, the docking of horse tails, and the cutting off their legs. These are to be found in Mr. Kirkland's Treatise; and the only principle, that is to say, the only general fact, which I have ever yet been able to discover, is, that an artery closes, not only immediately under the ligature, but for a considerable way above, that is, up to the nearest inosculating branch. The closing under the ligature is plainly the work of the ligature; the obliteration of the canal, higher than the ligature, is supposed to arise from this contraction of the artery.

to wait for their retraction, and should conclude, with Petit, that a compress, or the slightest astringent, were better and safer than the needle. Those speculators did indeed draw this bold conclusion from their theory. "In all smaller arteries, it is," say they, "sufficient just to clap the point of a finger upon the artery, and wait till it has shrunk."

[We ought all to know the consequences of this practice of stopping the bleeding vessels by clapping the finger on the mouth of them. Suppose, for example, that the surgeon is extirpating a tumor, first one artery throws out its blood, and then another. The fingers of the assistant surgeon are employed in compressing these, and at length the operation is finished, and then they set about taking up the arteries. But where are they? not one orifice will bleed. The loss of blood, the apprehension of the patient, and his exposure, and finally the compression has stopped the blood. But in the night, when he is warm in bed, and the pulse begins to rise, then the vessels bleed afresh; the bandages, straps, and dressings, have to be undone, and the arteries secured with ligatures after all. Here I speak of the lesser branches divided in the extirpation of a tumor, the mamma, for example; but the remark applies more strongly to the trunks *.]

This doctrine, then, is as dangerous as that of Mr. Petit: when a hæmorrhagy is interrupted only by clots, or when a hæmorrhagy has relented from the mere contraction of the artery, the patient is never free from danger, nor the surgeon from alarm. Doctrines like these will never serve as a basis for sensible rules of practice; and I think it therefore

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* Observation of Mr. C. Bell.

important, in this place, to explain to you my own opinion of this matter; for, whether an artery be tied, or have stopped spontaneously, it is in a condition very different from what has been hitherto described; and many of the precautions, I shall afterwards recommend to you, must have a very direct relation to the condition of the artery, which neither is closed by the contraction of its circular fibres, nor obliterated by the pressure of the cellular substance.

Let us then consider the following points of doctrine, with the practical inferences that are to be drawn from them:—First, The natural causes by which a hæmorrhagy is stopped; and, secondly, The condition of an artery when tied with a ligature.

OF THE NATURAL CAUSES BY WHICH A HÆMORRHAGY IS STOPPED.

When an artery has been tied securely, we are, from that moment, free from all uneasiness; but when it stops merely by pressure, by astringents, by the formation of clots, by the contraction of the artery itself, whenever hæmorrhagy stops from any natural cause, it is apt to return; and we inquire anxiously into those natural causes for this reason, that hæmorrhagy is at the first easily stopped; it ceases even from the faintness of the patient, if not by the interposition of the surgeon; but it is this accident of secondary hæmorrhagy that chiefly alarms us.

When hæmorrhagy stops of its own accord, it is neither from the retraction of an artery, nor the constriction of its fibres, nor the formation of clots*, but by the cellular substance which surrounds the artery being injected with blood; and, to be assured of this, we have but to observe, what happens in arteries of various sizes. First, Let us suppose the wounded artery to be so small as just to spurt out its blood; the stream of blood gradually lessens, because the artery is emptied, and the resistance to the arterial action taken away; the stimulus being gradually lessened, the artery every moment acts less powerfully, and the blood, being no longer solicited or urged on by the arterial contractions, forsakes the open artery, and moves along the neighbouring branches. The surgeon claps the point of his finger upon the mouth of the artery, and holds it there; the outward bleeding is prevented; the blood is extravasated into the cellular substance round the mouth of the artery; the cellular substance is slightly injected with blood; that blood coagulates; and that slight barrier is sufficient to restrain the bleeding of a small artery, till the parts inflame, and the artery is entirely stopped.

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* See the note, or comment, below.

Secondly, Supposing the artery still larger and more powerful, and that it drives its blood very furiously among the cellular substance, it is not this slight injection of the cellular substance that will restrain the bleeding: whenever the finger is removed, the blood bursts through this slight impediment. The injected cellular substance will not support the artery, unless the cellular substance itself also be supported. Suppose, then, that the surgeon first claps his thumb firmly upon the artery, and then thrusts down a piece of sponge close to the wounded artery, applies over that a compress, and bandages over all, to support the sponge and compress in their place; the artery still bleeds (though in a restrained way) both into the cellular substance beneath the sponge, and into the sponge itself, till at last the blood coagulating in the sponge, and in the cellular substance, they become as one mass, and often the sponge keeps its place till the parts inflame and suppurate, when, of course, the coats of the wounded artery unite along with the other parts.

Thirdly, But often it happens that the blood, which was at first firmly coagulated, begins to lose its consistence; or that, by some unwary motion, or by a febrile excitement, the artery acts violently; more of the cellular substance is filled with blood, and the first firm coagulum and the sponge being removed from the mouth of the artery, the softer cellular substance, behind them, is filled with fluid blood, and the artery, forcing that slighter obstacle, bursts out again.

Fourthly, Supposing the surgeon to be bold, but not dexterous, and that, in place of using the sponge, he makes a dive with the needle at that part which he observes the bleeding to come from. He never sees the proper mouth of the artery; the injected cellular substance conceals it from him; he thinks he has tied the artery, when, in truth, he has tied only the cellular substance over the mouth of it; the bleeding is suppressed for a moment; the cellular substance, betwixt the mouth of the artery and the ligature, is filled with blood; that blood coagulates; the ligature serves but as a compress, till some accident fills more of the cellular substance; the mouth of the artery is farther removed from the ligature; the cellular substance dilates, in consequence of the artery injecting it with fluid blood, till at last it gives way, and the hæmorrhagy bursts out anew. Thus we perceive, that retraction of the artery has no effect in suppressing hæmorrhagy, but as it fills the cellular substance; and that this injection of the cellular substance is but a slight obstacle, fit to support only the very smallest arteries. The natural powers which restrain hæmorrhagy do but suppress it for a time, and expose the patient to secondary hæmorrhagies; and sponges and styptics are hardly to be trusted any more than the mere retraction of the artery. The hæmorrhagy is seldom restrained, by such means, long enough to allow of the inflammation of the parts, or the obliteration of the wounded artery.

The condition of the wrist, or any other naked part, and especially the sudden swelling, and the frequent eruptions of blood, after a wound in the artery, are not to be explained by any other doctrine than this; and I am well contented to take a wound of the Radial Artery as a proof and example of this theory, for the accident is peculiarly frequent. The radial artery is one of that order and size which cannot be restrained but by the ligature. The superficial situation of this artery, the nakedness of the bone on which it lies, the great swelling of those naked and tendinous parts a few hours after the artery is wounded, the difficulty of finding the artery, and the cruelty of the operations which have been performed, make the case important, both as a common piece of surgery and as a general example of this kind of wound.

The radial artery, at the place where we feel the pulse, lies quite superficial. We even see the beating of the artery through the skin, and when we dissect the wrist, or look to a preparation, we see nothing but the artery betwixt the skin and the bone; yet when this part is wounded, we seek in vain for this superficial artery; we search for it by cutting through a most unexpected thickness of parts; this artery, which was felt so readily with the finger in its natural condition, we cannot now feel beating, even though the skin be open and the wound deep. We observe the best surgeons at a loss to find the artery; we find them thrusting down sponges, leaving tourniquets half screwed about the arm for many weeks; making unsuccessful incisions, diving in vain with the needle, and at last striking the needle through the whole thickness of the arm, so as to intercept the artery with a coarse ligature at the distance of three inches above the wound*. These difficulties never can be explained by attending only to the anatomy of the natural parts; here the diseased and the sound state of the parts must be described together, and anatomy and surgery must go closely hand in hand.

The artery of the wrist lies not immediately under the skin, but under a thick fascia, which, in its natural state, attracts but little notice. The general fascia of the fore arm, strengthened remarkably at the two condyles of the shoulder bone, and farther reinforced by the tendinous expansion of the biceps muscle, descends very strong along the fore arm, enclosing all the flesh; the fascia is very thick at the wrist, where, though it is a firm and continuous web of tendon, its glistening fibres are distinguished running across the arm, and binding down the flexor tendons. Under this fascia the radial artery lies: this fascia is connected with the tendons below by a loose and gliding cellular substance; and it is moreover to be remembered, that all through the body each artery has its own peculiar sheath of cellular substance; even the smallest muscular arteries have such a sheath. This fascia, which is itself but a firmer cellular substance, is surrounded with a looser tissue of cellular membrane, both on that surface which lies upon the muscles and on that which is connected with the skin.

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* Mr. O'Halleran.

No sooner is the radial artery wounded, than the awkward attempts of the assistants prevent the blood bursting out freely; the cellular substance of the skin is injected with blood; and the skin, long before inflammation could come on, is inflated, as it were, to a great thickness. The artery shrinks under its fascia; the cellular substance of the fascia is injected with blood; it rises over the mouth of the wounded artery; it is injected not like the looser cellular substance of the skin. This firmer cellular substance of the fascia is so crammed with blood, and that blood is so firmly coagulated, that the parts are, as it were, baked together, and the hæmorrhagy is rather an oozing of blood from a substance resembling the Corpus Cavernosum Penis. The whole bottom of the wound is a fine fleshy placenta-like mass; and, after dissecting with the knife through a great thickness of parts, the artery is not to be found, or only by those who are very perfectly acquainted both with these changes and with the natural place of the vessel. This is the confused fleshy-like mass into which the surgeon strikes his needle. Here the blood is seen oozing, as through a placenta, at many places, but not one of those bleeding points corresponds with the mouth of the artery; so that, when the surgeon strikes his needle at these bleeding points, he must fail. The oftener the blood bursts out and is suppressed, the more does the wrist thicken; the farther is the artery removed from the surgeon, and the more confused the parts become. It is by this extravasation into the cellular substance that the artery always disappears, and the bleeding ceases, before the surgeon is ready to take it up with the needle. The patient loses blood from day to day, he becomes pale, sickly, and exhausted, till at last the blood hardly retains so much colour as to tinge the sheets *.

But another phenomenon often presents itself, a natural consequence of this state of the parts. A person is brought to us, a week after the radial artery is wounded: it has burst out again and again; perhaps the hæmorrhagy has been suppressed by sponges, by compression, or by a rude stroke of the needle; but, upon undoing the dressings, we are surprised with the appearance of a distinct aneurism in the bottom of an open wound; we see a small distinct pulsating tumor, regularly circumscribed, throbbing strongly, with thin and almost transparent coats. We are at first at a loss to imagine how such tumors are formed or supported. But though the wound be open, the artery is not so; the cellular substance is partly injected with blood; the first effusion of blood is driven into the cellular substance, mixed with it, and firmly coagulated; the second effusion has filled more of the cellular substance with recent and fluid blood, and raised it in the form of an

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* Many cases may be found in White, O'Halleran, Aitken, &c. where a person, wounded in the radial artery, has bled for three weeks or a month, till the blood was little better than a reddish serum. I have taken up the radial artery after a person has been suffered to lose blood ten or twelve times during the course of a fortnight.

aneurism; and this aneurism has for its transparent coat the general fascia of the wrist; but yet it is so fairly circumscribed, that one would hardly doubt of its being a dilatation of the artery itself.

If I do not mistake the importance of this accident, it is a sort of duty to explain it to you still further; for though the operation of tying the radial, or ulnar artery, does not range in the catalogue of important operations, along with trepan and amputation, yet, if I be not deceived, it is more difficult than either, and certainly more frequently required.

" A shoemaker having been at an annual dinner with some young men of his own trade, had got merry, but was not intoxicated; and some of his companions walking home with him, he swore a hearty oath that they should not pass his door without tasting a glass. Accordingly they went in along with him, and as he was reaching up to a cupboard for a bottle of spirits, an unlucky foot encountered his, and tripped him. He fell forward, and a nail which stuck out from the wall run into the palm of his hand, and wounded the palmar artery. Instantly there was a dreadful bleeding. He fell down at last in a faint; and so unskilfully was this poor fellow managed, that, in the course of a fortnight, he had been allowed to bleed no less than eight times. The blood burst out afresh on the slightest motion, and at intervals of no more than two days, till he was reduced to extreme weakness. He had lost immense quantities of blood. It was only by his shape that I could perceive that he had been originally a fine athletic and healthy young man.

" I found him, indeed, in rude hands. The surgeon who had attended him, and who was to perform the operation, knew nothing of the palmar arch, where it began, or to which of the two arteries it belonged, nor whether it lay above or under the ligament of the palm; and so much was he alarmed, and so ignorant of any but the rudest means of stemming the torrent of blood, that he had a coarse bandage twisted round the hand as firm as a tourniquet! The tourniquet itself was still round the arm, hard screwed; and the hand, by long continued pressure, was now black, not merely from extravasated blood, but from actual gangrene; vesications appeared on it betwixt every turn of the roller. The palm of the hand was greatly heaved up and swelled, with a puffy kind of swelling. In seeking for the artery the thick skin of the palm was first cut through; it was very thick, and exceedingly crammed with blood. The cellular substance, belonging to the palmar aponeurosis, was crammed also with blood, was fully two inches thick, quite black; it was all one uniform mass, which cut like the corpus spongiosum penis, and no one part was to be distinguished from another.

" The artery, with its usual perverseness, (though it had almost bled the man to death), would not give one drop of blood during the operation. The surgeon unscrewed the tourniquet, doused the parts with warm water; made the patient swing his hand most painfully; made several rude incisions, but still could get no jet of blood from the artery, nor any more than a general oozing from this spongy mass. Without fear of the palmar nerves, he made many relentless and unsuccessful dips with the needle; at last he was most unwillingly forced to make an incision upwards along the artery: he cut the skin by the side of the flexor ulnaris muscle, and looked in vain for the artery; was surprised that he could not see an artery which he felt plainly with his finger, not knowing that the artery was still covered with its fascia;—but having at last slit up the fascia, the artery was forced out by the tenseness of the fascia; and from its fulness it assumed a contorted form, and was especially turgid at each pulsation. Three inches of the ulnar artery now lay exposed; it was seen running over the pisiform bone into this spongy mass in the palm; the artery beat strongly, and was seen serpentine, and working with a sort of spiral motion, and a distinct pulsation; but there was no corresponding jet of blood, nothing but a general oozing in the palm.

"The conclusion of the case is as extraordinary as all the rest of it; the surgeon laid a ligature under this part of the artery, but would not draw it; he made another desperate dip with the needle: The lad was put to bed, and the bleeding broke out so furiously in the night-time, that had there not been a pupil watching to tie this occasional ligature, he surely must have lost his life."

This case explains to us what confusion the continual driving of the blood makes; how deep the artery lies in parts which seem to have little cellular substance, and how vain it is to look for the artery in the midst of such a mass; the artery will not bleed till all is quiet again; and even when it does bleed, it is not with a fair jet, nor with open mouth. To suppress such bleedings with a styptic, or a compress, seems to be a lenient, but is, truly, a cruel practice, and not without danger. The patient's constitution, if not his life, is often endangered before the surgeon gets courage to make the incision; and at every return of hæmorrhagy the cellular substance is more and more injected; the artery buried deeper; the incision must, of course, be more extensive, and the operation more difficult.

[The following case will prove the importance of the radial artery, and that although it will spontaneously cease bleeding if it be torn, or shot through, yet if it be opened as with a piece of glass, or by the lancet, it will bleed the patient to death.

A stout young man having hurt his wrist, an abscess formed on the back of the hand. This abscess the surgeon thought it necessary to open with his lancet; and in doing this, Heaven knows how, he opened the radial artery! Disliking the operation of dissecting for the bleeding artery among swollen and inflamed parts, he took it into his head to operate on the principle of Mr. Hunter, as he called it, and tied the humeral artery at the bend of the arm. But in truth he did no such thing; for he mistook the radial nerve for the artery, and tied it! It of course followed, that shortly after this came another terrible bleeding from the artery of the wrist, and then another and another hæmorrhage, and then the poor fellow died*.]

The aneurism which I have described, as formed under the fascia, and protruding from the bottom of the wound, I choose rather to exemplify from the writings of another person, than from my own case-book. Mr. Ford, of the Westminster Hospital, "was called to a butcher who had, about a fortnight before, wounded his wrist, by pushing his hand through a pane of glass. The wound was just below the carpal ligament, over the pisiform bone. It had bled several times since the accident, and the hæmorrhagy had, with difficulty, been restrained by bandages and common dressings. *There was a pulsating tumor, covered with a thin membrane, where the wound had been received;* the pulsation was with difficulty checked by a strong compression on the ulnar artery, but returned again on removing the compression.

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* By C. Bell.

" I dilated the wound instantly," says Mr. Ford, " towards the palm of the hand, and made an attempt to include the vessel within a ligature, by means of the common crooked needle. This proving ineffectual, I represented to the patient the necessity of a farther dilatation of the wound, in order to restrain the hæmorrhage, without injury to the ligaments and tendons of the wrist; but, notwithstanding the most urgent entreaties, he could not be prevailed on to submit to any farther operation till the ensuing day; he was therefore left with a bandage on the wound, and the tourniquet applied on the upper arm, with directions to tighten it if the hæmorrhage should return.

" I saw him again on the next day, in company with Mr. Lynn, surgeon of the Westminster Hospital, and finding that the bleeding had recurred, it was determined to prosecute the incision farther, and to secure the artery higher up in the arm.

" I began the incision where the wound had been received, carrying it superficially over the carpal ligament, in the direction of the ulnar artery, for six inches upwards in the arm.

" The operation was done with the utmost caution, to avoid wounding the tendons and muscles, which were carefully held aside with our fingers as they were exposed by dissection. This proceeding was of course tedious, in order to ensure safety. The pulsation of the vessel could not be felt; neither could the hæmorrhagy be provoked by friction, by putting the arm in warm water, or by flannels applied hot to the part. At length, however, the artery was discovered, and a ligature carried round it, without including any other part, about an inch and a half above the wrist. Some time was then employed in endeavouring to promote a hæmorrhage from the lower branch of the artery; but this not taking place, the wound was carefully cleaned, united with strips of sticking plaster, and rolled up with a flannel roller.

"The patient was bled, had an opiate administered, and in every respect was treated in a most antiphlogistic manner. No circumstance occurred to render it necessary to open the wound for six days; no swelling, tension, inflammation, or fever, came on. Now, it may be remarked, that the circular ligament of the wrist, together with the tendons and muscles contiguous to the ulna, had been laid bare, and exposed to the air for more than three quarters of an hour, during our search for the artery. The ligature came away on the eighth day, and the wound healed rapidly by the first intention, so that the patient was perfectly well on the twenty-eighth of the same month."

I know Mr. Ford, and am sure he will pardon any observation that is meant for the improvement of others. I believe it is needless, in any such case, to cut downwards into the palm of the hand, which is usually so injected with blood, that the most dexterous anatomist, dissecting deliberately on the dead body, would not find it easy to show the open mouth of an artery; and it were superfluous to repeat to you how improper it is to dive with a great needle into the palm of the hand; nor is this necessary; for the palmar fascia and skin are so swelled as to prevent the return of the blood from the lower mouth of the artery. I never saw it necessary to tie the lower end of this artery, and I think it important to mention this as an exception to the rule commonly laid down of tying both ends of it: it is only the direct impetus of the blood from the upper part of the artery that bursts through this injected and spongy mass; it is only the upper end of the artery that we need to tie. Irregular and unsuccessful operations are performed only from not having a very decided intention of dissecting for the artery; but it comes always to this in the end; and the surgeon should resolve, the moment he is called to such a case, to apply the tourniquet; to cut backwards along the artery; to dissect it clean; to tie it fairly; to disregard the bleeding from the lower end of the artery; to put a small piece of sponge into the place where the blood wells out from this confused mass, except in those very rare cases where he sees a direct jet of blood from the lower end of the artery, and then he may use the needle; but that rarely happens, except in very recent cases, and before the palm is much injected with blood.

[Being absent, my assistant was called to a patient who had wounded himself in the radial artery, where it turns round from the wrist to the back of the hand. He made a cut upon the wrist, and tied the radial artery, and stopped the bleeding from the wound. Half an hour after returning home he was sent for; the bleeding had returned from the original wound. How would the reader proceed on such an occurrence? My assistant reflected that this second hæmorrhage was from the circuitous arteries of the palm, and that a compress would be sufficient to stop the bleeding; and the event proved that he was right*.]

† Surgeons, from the very earliest times, have been fully sensible of the danger of this wound in the wrist; insomuch, that finding often their styptics, vitriol buttons, pellets of chewed paper, and hard compresses, with coins in them, ineffectual! they invented a particular machine for the wound of the artery of the wrist; and a more formidable machine can hardly be imagined. It is formed of two great hoops of iron, connected by three flat iron rods, with strong hinges, and studded with iron nails to give it strength; it resembles our machines for broken legs, and most of all, Gooch's machine for the fractured thigh bone. One circle goes round the elbow, another surrounds the wrist, and within this circle is a large padded compress, moved by a strong screw, which compresses the artery. The very form of this

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* Observation by C. Bell.

† The justly celebrated Mr. White relates the consequences of bleeding from the radial artery, in the following terms:—"The arteries of the wrist having been cut, had been twice taken up by Mr. ——, a surgeon well accustomed to the operation, and bovista and many other things had been tried. After each of these methods, the hæmorrhagy stopped for a few hours, and then frequently burst out again, especially upon the accession of a hot fit, to which he was now very liable. On the seventh day I was called, in consultation with Mr. Allan, to take off the arm. We found his hand and arm swelled to three times its natural size, from the frequent use of the tourniquet, which had been under a necessity of being moved to different parts of the arm, on account of the excoriations it had occasioned. For the last twenty-four hours it had been applied almost without intermission, from a dread of his bleeding to death, as he had lost a prodigious quantity of blood. After the dressings and clotted blood were removed, we could distinctly see the mouth of the vessel, throwing, per saltus, what I can scarcely call blood, as its colour could hardly be distinguished upon linen." —*White's Cases.*

machine shows the extent of their fears; much more the words in which Scultetus explains it:—"Comprimitur arteria carpi consilio aut fortuito aperta, ne vitam cum sanguine profundat *." And he adds, "that it is peculiarly serviceable in such punctures of the arteries of the carpus, as sometimes happen in duels with the small sword." The means of suppressing hæmorrhagy were imperfect among the older surgeons, and it was not without reason they feared these wounds of the carpus. We have, in the following case, a proof at once of the difficulty with which they restrained such hæmorrhages, and of the ill consequences of styptics and compression.

"One John Moser, a shoemaker, having a dispute with his apprentice boy, the wicked imp, while he was struggling with him, cut him across the wrist with a paring knife. The vein and artery being wounded, he bled profusely, with other distressing accidents. A regular surgeon being called immediately, bound up the wound according to art; but next day the blood burst out so profusely, that he was agitated with universal convulsions. On the seventh day it burst out again; he said that all night long he had dreamed of struggling with the boy; and in the morning, wandering up and down lamenting the expenses of the affair, he wrought himself up into a fever, so that the blood burst out again with all its violence, and could by no means be restrained,

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* Consilio aperta must be explained.—"At Pavia," says Scultetus, "where anatomy and surgery have flourished for many ages, there appeared in my own day a most dexterous Arteriotome, who, at the instance of the physicians, made very free with the radial artery, and, by opening it at the wrist, cured the most severe diseases of the head; and he used this compressing machine, so that not one drop of blood issued, nor did any bad consequence of such compression ever ensue."

till Scultetus, clapping his finger upon the mouth of the artery, and hooking out a great quantity of coagulated blood from the wound, laid a piece of burnt sponge upon the artery, dipt in astringents mixed up with whites of eggs; bound up the wound with firm bandages, and put the great spring bandage, which I have just described, over all. In this case we may observe what quantities of blood the patient loses in these wounds; and by the reports of Scultetus, we are made sensible of the great sufferings this particular patient must have endured; for, on the ninth day, the arm was greatly inflamed; on the tenth the patient was somewhat relieved, and the yellow pus began to soak through the bandages; on the eleventh he was tolerably well; on the twelfth the wound was dressed. The wound was very large, both from the quantity of coagulated blood that had been hooked out, as from the cavity of an aneurism, and by the dilatation of the sponge; and the tendons of the wrist were exposed, and not only inflamed, but even tending to gangrene."

We find Scultetus screwing his compressing machine at every dressing, getting away the sponge very slowly, and piecemeal, the pain considerable, the matter in great profusion, the sufferings of the patients in all respects very great; and I have no doubt, that, by such long continued suppuration, the tendons would be fixed in their places, and the hand would continue lame. But not even the coarseness of this machine, nor the manner in which they used it, nor their irregular practice of using sometimes compression, sometimes vitriols, sometimes the hot iron itself, in wounds of the wrist, can explain to us the extent of their difficulties and fears.

[The history of these cases fertilizes the mind. I shall here inform you how I have compressed the anterior tibial artery, on the fore-part of the foot, near the ancle joint. Having put down a compress of lint upon the artery, I took two bits of flat stick, of eight inches in length, and an inch in breadth. One of these I put on the upper part across the foot, and another across the sole, and tied their ends together. The upper one pressed upon the linen compress, and the cord which tied the sticks together, being twisted, graduated the pressure. In this manner the circulation of the foot was not at all impeded, and the compression on the wounded artery was complete *.]

Mr. O'Halleran's operation, though not new, (for it was performed by Paré, Guillemeau, and even by the Arabians), is more desperate than all these:— "He takes," to use his own words, "the largest convex needle, armed with six or eight threads, made flat and smooth with wax, pierces the skin about an inch above the wound, and near the same distance from the beat of the artery at one side;— he passes the needle first under the artery, and out at about half an inch distance on the other side of it. The threads being thus passed, and comprehending the artery, and the surrounding fat and muscular flesh, let a small roller of fine linen, not made up hard, be placed over the artery, and on this let the ligature be made," &c. And he ventures even to give examples of cases so desperate as to require this very desperate operation †. I would not have you

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* Observation by C. Bell.

† A gentleman of this city, in May, 1762, by some accident struck his left hand through a pane of glass. A pretty considerable

entirely ignorant even of this rude operation which O'Halleran, a very excellent surgeon, manifestly considers as new and ingenious, as a happy invention, which saved the person's life, and "which he thinks will be the means of preserving the lives of others."

I hope not. I hope that you will be able to save the lives of your patients on easier terms. There is nothing peculiar in this radial artery; the confusion arises from those causes which I have endeavoured to explain. The confusion of parts is from the

wound of the wrist was the consequence. The radial artery was also cut through, and some smaller ramifications were wounded. The arteries bled very freely; and soon after I was sent for, finding compression not answer cleverly in this case, he being a little heated with liquor, I took the resolution of making the ligature of these vessels, especially as it was after night-fall. This done, the bleeding ceased, and I dressed the sores with soft lint, applying a cushion of tow to the bend of the arm, to break the force of the blood, which was secured by a proper bandage. The sore was not opened for two days after, and every thing went on in a very promising way. In about seven days the ligature dropped off, and I now recommended to him the greatest caution and temperance. He, nevertheless, made use of this hand on every occasion; and as my advice was not paid the deference I imagined due to it, I insisted on being discharged, which was complied with; for it was imagined I made much more of the affair than it deserved. But though the sore healed up, yet, in about three weeks after, upon some very violent effort, the radial artery ejected blood with great impetuosity, and I was again, with many entreaties, requested to visit him. I clapped a good deal of lycoperdon on this part, which I pressed on with my finger. Over this a good deal of soft unformed lint, a compress over the artery, and secured the whole by a straight bandage; and, as the pulse was very full, took some blood from the other arm. Things remained thus for about five days, when, upon some excess, a fresh hæmorrhagy came on, which was again mastered. In two days more, it began again; on which I had Mr. Mahony, a good operator and surgeon, called in. The following morning it came on very violently; and, apprehensive that such frequent relapses would endanger his life, amputation became seriously thought of. I, however, told them I had one means more unattempted, before we should come to this disagreeable necessity, and the next day I had full occasion to put it to trial; for, on some driving of the blood! the temporary suppression of hæmorrhagy but increases the danger, and successive bleedings bring the patient to the brink of the grave, and have often occasioned the loss of a limb. There is no safety in trusting to compression, sponges, or astringents, for you are yourselves never free from anxiety, nor your patients from danger; the blood bursts out again, and all those intervals of expectation, and those apparent successes, only increase the difficulties of the case. To temporize is cruelty, and not mercy! for in the end it always comes to this,

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very slight motion of the hand, it bled with great profusion, and I was sent for. In this situation, in the presence of the other surgeon, &c. I passed a convex needle, armed with three threads, smooth, flat, and well waxed, about three-fourths of an inch higher up than the gaping orifice of the artery, and at some distance from this vessel; pierced the skin and fat, conveyed my needle under it, and again out at the other side of the artery; put some lint between the spaces of the wounds, over the artery, and on this made a pretty tight ligature. All bleeding immediately ceased; the orifice of the artery soon healed; the skin became firm over this part; in about a fortnight after, the ligature cast off; and he now has the use of that hand as firm as the other. Thus, by a new and truly curious operation, was a limb preserved, and will, I hope, be the means of saving many others in similar accidents. Had such a method been taken in the following case, a poor man might have preserved his arm.

I also deliver the following case from O'Halleran, to show you to what extremity this hæmorrhagy from the radial artery has sometimes reduced the patient.

"The butler to a gentleman at some distance from this city, about ten years past, in wiping a glass, it happened to break; by which accident he received a considerable wound of the wrist, in which the radial artery was divided. It bled violently, and with some difficulty was it mastered by Mr. White, an ancient surgeon here. The bleeding returned in two days; again in five; and thus continued bursting forth at times, on the least motion of the hand, for near a month. This great loss of blood having greatly fatigued and weakened the patient, on a consultation with the late Mr. Gould, amputation of the arm was resolved upon, and performed on the very next return, by Mr. White, in the presence of Dr. Martin; and the man soon recovered, but was rendered incapable of service."

that you must make an incision, open the fascia, and look for the artery. You must use the needle, because you succeed best by putting your ligature round the artery itself, (and not merely by tying the open mouth of it).

This is my idea of the condition of a wounded artery, and these the practical inferences which I presume to deduce from this simple theory. But there remains a subject of inquiry still more important, I mean the condition of a great artery when tied with a ligature, or reunited by compression; for that discussion is a necessary prelude to my observations on great aneurisms. Here, also, I am not afraid to acknowledge there is a connexion betwixt theory and practice which it were hypocrisy to deny.

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* The account of the cause of the spontaneous stopping of hæmorrhage in the smaller arteries, and the practical inferences drawn in this chapter, cannot be exceeded for correctness of doctrine, ingenuity, and sound practical rules. But the whole subject is not brought before us, nor are we one step advanced in the correct theory, by those who have written in the intermediate time betwixt the first publication of this work, and the present commentary. We must state the difficulty; for authors have shown more cunning in shirking the question, than ingenuity in explaining it. Their little ways of praising one another, and going round about to omit the mention of my brother, have been apparent to me. They have been as a child who conceals itself by covering its eyes.

* Commentary by Mr. C. Bell.

The question is this:—An open artery, of the largest size, the axillary artery, for example, lying in the bottom of a wound, spontaneously ceases to bleed. What are the circumstances which produce this cessation in certain cases, while, in other instances, we see the patient die of hæmorrhagy, either suddenly, and as it were by one gush, or gradually drained by a succession of bleedings? The first important fact which experience exhibits to us is this,—that if an artery be opened with a sharp instrument, and with comparatively little injury, it continues to bleed profusely; if, on the other hand, it is rudely torn or bruised, it does not bleed. If the radial or ulnar artery be opened with the lancet, as in the case already narrated, or if it be cut by a fine piece of glass, as often happens, it bleeds so as to require an operation. But if the parts be torn, or crushed and bruised, while the artery has been opened, or if a musket ball has passed across the artery, dividing it, little or no blood escapes, and it may not be necessary to tie the artery at all! It serves only the purpose of delusion to speak of the retraction of the artery, the contraction of its mouth, the exhausted force of circulation, the burying of the artery in the coagulum. This is all true, but it is not the whole truth, nor is it to the purpose. I shall state it again. When the arm is drawn off by machinery, or torn off by round shot, and the artery lies exposed, why does the artery not bleed, and how does it happen, that from such a wound a man recovers without an operation on the artery, while the smaller arteries wounded in other circumstances, as seen in this chapter, will be attended with fatal hæmorrhage?

I assign this reason, and I shall prove it practically.

The coats of the artery being alive, and in the full enjoyment of their functions, preserve the blood fluid. But the blood deprived of that influence immediately coagulates. The death of the coats of the artery, or the injury of the coats of the artery, are attended with the coagulation of the blood within the mouth of the artery.

This is the reason why, on cutting into mortified parts, there is no bleeding; the blood has coagulated in the cavities of the arteries. It is the reason why a bruised, torn, or gunshot artery does not bleed. It is the reason that an artery presenting in a wound, and throwing out its blood in a stream, being seized upon, and twisted and bruised, ceases to bleed, although you still see the artery standing up with open mouth; that open mouth is corked with a coagulum, the consequence of the injury, or, in other words, in consequence of destroying the influence which the coats exercise over the blood. As we proceed, we shall find, that whenever the relation betwixt the proper coats of a blood vessel and the blood is interrupted, coagulation takes place. If blood escapes into a cavity, it coagulates. If it escapes into the cellular membrane, it coagulates. If the coats of an artery give way, and the coats are supplied by a new formation out of the cellular membrane, the blood coagulates; and this is the reason why an aneurism is ascertained by the presence of clot. For if the coats of an artery be dilated merely, there is no coagulum; but if any part of the sac be formed of cellular texture, condensed, there you find a clot.

No doubt, whatever debilitates, as bleeding with the lancet, and whatever diminishes the impetus of the circulating blood, assist in arresting hæmorrhage; neither will it be denied, that a certain retardation must be the consequence of the retraction of the artery. The contraction of the mouth of the divided artery, too, has its effect, and most of all has the formation of the coagulum over the mouth of the artery its effect, in stopping hæmorrhage by a spontaneous process; but the great and prevailing cause is the coagulation and adhesion of the blood within the mouth of the artery; and that coagulation and adhesion is produced by the injury done to the coats of the artery.

OF THE CONDITION OF THE ARTERY IN ANEURISM, AND OF THE EFFECTS OF THE LIGATURES UPON THE ARTERY.

Even that aneurism, which proceeds from a direct wound of the artery, grows very slowly. When the brachial artery is wounded in bleeding, we find no tumor on the first day; on the second or third day the aneurism begins to form, but is then no bigger than a pea; it is small, round, hard, and circumscribed, and seems attached to the side of the artery; it is a week before it attains the size of a walnut, and a fortnight before it is as large as a pigeon's or hen's egg; and it is only at the end of six weeks that it acquires the full size of an aneurism, such as is usually the subject of our operations.

The old physicians observing this slow growth of aneurism; seeing the tumor regularly circumscribed, and apparently attached to the side of the artery; imagining, also, that they could press back the blood from the aneurisacal sac into the canal of the artery, could not believe that this artery was actually wounded! they believed it to be merely dilated; they conceived that the point of the lancet had touched the external coat only; that, in short, the artery was pricked, but not wounded. They thought that the external coat being thus injured, the internal coats, no longer able to resist the impetus of the blood, had given way*; or they believed, that though the outermost coat of the artery when wounded may in time close again, yet the innermost coat being thinner, will not so easily submit to a cure as the other, seeing it is continually in danger of being further dilated by the impulse of the arterious blood.

This last opinion I have detailed from Purmannus, the celebrated Silesian surgeon, who ventures a step beyond his compeers. They only guessed that the artery was dilated—he pretended to demonstrate it! He not only delivers, in the following case, a formal narrative of the brachial artery dilating from the diameter of a straw to the bigness of a man's head! "without breaking the vessel," which is no doubt "very wonderful to think of," but he is so adventurous as to give us a drawing of this sac, as if he had tied two ligatures round the artery, and cut out the intermediate piece, with this sac or dilatation as big as a man's head! One feels at every step how dangerous it is to receive, too implicitly, reports, which are inconsistent with common experience and common sense. The case is delivered by Purmannus in the following words:—

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* "Quod in dilatata vena varix dicitur, in arteria prœter naturam expansa aneurisma est." This is the definition with which Ruisch begins his case of aneurism; and the opinion here expressed was indeed universal.

"In the year 1680, I had in cure a gentlewoman at Halberstadt, named Anna Peters, about thirty-eight years of age, who had a large aneurism upon her left arm of three years' continuance, the form and bigness whereof may be seen in Tabul. 5, fig. 11. This misfortune came by a chirurgeon of Blanckenburg's letting her blood, who thrust his lancet through the vena mediana into the artery that lay under it, which caused a tumor of a vast bigness. At my first handling the pulse, I thought the blood run out of the artery between the muscles; but afterwards I found the contrary, and that it was an extension and dilatation of the artery; which certainly is a very great wonder to think upon, that a vessel no bigger than a straw should extend itself to the bigness of a man's head, without breaking the vessel. This gentlewoman was not sensible of any great pain; but her arm was extremely wasted, and in a manner utterly dried up; which was very serviceable to me, for I could sooner find the artery; under both sides whereof I thrust a needle and silk, and tied it close together, and, cutting it through between the two tyings, took it out very happily and quickly, with the assistance of Mr. Kraue, a chirurgeon at Quedlinburg; and the patient was cured in a month's time. Here I think myself obliged to acquaint you, that though this gentlewoman had worn several ligatures, compressors, and leaden plates during the first year, yet it took its course, and nothing could have any effect upon it. The atrophia, or wasting of the arm, I cured with the balsam and mixture mentioned in the foregoing chapter."

There is hardly any author, indeed, who does not affirm the aneurism produced by a wound to be a true aneurism; and the imperfect reunion of the internal coat of the artery to be the cause of the dilatation. Thus, Tulpius, in mentioning a wound of the artery of the thumb, with a very sharp pointed knife, says, "The external coat alone reunited, which being unsupported by the internal coat! was unable to bear the force of the blood;" and even this breach of the internal coat, this "hiatus tunicæ internæ arteriæ," they thought they could cure, and yet preserve the canal of the artery.

Thus the old writers, who were rather speculative anatomists than practical surgeons, imagined these ingenious, but puerile theories, which still hold their place in the systems of the present day; their refinements upon this subtile doctrine are endless. De la Faye, in the following passage, not only compares the blood forcing the internal coat of an artery through the wound of the external coat, to a hernia of the abdomen! but he pursues his speculation farther. he adds, "It is important not to mistake this aneurism, arising from a partial dilatation, for that in which all the tunics are equably expanded; for the former we often cure by compression, but the latter never; because the whole circumference of the artery being dilated, if you press it on one side, it will protrude on the opposite side."

They did, indeed, remark the jetting of the blood as a sign of wounded artery! but they willingly forgot this decisive sign of a direct wound, in favour of their darling theory of dilatation. They boldly believed, that even that aneurism which proceeded from a wound of the lancet was but a dilatation of the artery. Thence came the scholastic distinctions of aneurisms, into true aneurisms, proceeding from a pure dilatation of the artery; and false aneurisms, proceeding from a direct wound of the artery; and mixed aneurisms, where a true aneurism had terminated in a false one! or, in other terms, where an aneurism, consisting at first of a mere dilatation of the arterial coats, had been burst by violence, or had given way by over-distension, so as to pour out its blood into the cellular substance. Then it was, that surgeons conceived the romantic hopes of repressing those protrusions of the arterial coats, without interrupting the course of the circulation in the main artery; or entering upon a bloody operation which they did not understand; or endangering gangrene, which never was out of their thoughts: that gangrene which has been so long the bugbear of surgery! They imagined, that even the wound from the lancet healed, and that the artery dilated from the injury done to its coats; they supposed it to be dilated from weakness; they compared this dilatation of the artery with the yielding of the peritoneum in hernia; and the dilatation of an artery, like the protrusion of a gut, was opposed by a spring bandage. The artists who made bandages for hernia of the groin, made spring bandages for this imaginary hernia of the arterial coats, by the same rules and principles.

They were at the same time ignorant of all the laws of the circulating system, and full of this expectation of healing arteries by compressing the wounded point; and they were withal so fearful of this terrible gangrene, that they never ventured to perform the radical operation for aneurism. Ruisch was the first, in the great city of Amsterdam, who found courage to tie the artery of the arm*, and even he operated only after the aneurism had burst spontaneously! But to tie the artery of the arm higher than the bending of the arm, was esteemed a problem even in the days of Sharp and Chesselden. The older surgeons cured only by compression; their Annulus Ferreus was a great spring bandage for compressing the dilated artery; they made their patients wear these awkward and uneasy instruments sleeping and waking for a full year, before they ventured to pronounce the cure perfect; and then they applied their Scutum Eburneum, an ivory compress, upon the artery! a sort of defending bandage, which some patients, for fear of future dilatations, wore for life.

When the celebrated Heister had obliterated a wound of the femoral artery, or to speak more correctly, had obliterated the femoral artery itself, by puff-ball, graduated compresses, and a very firm rolling of the limb, we find him expressing the same fears about the dilatation of the artery, and taking every precaution to prevent this accident. Before he removed those compresses by which the wound had been healed, he had others ready, of a peculiar construction, to prevent this dilatation, which, according to the doctrine of that day, was likely to follow such a wound. His fear was, lest the new and soft cicatrix of the artery should, in the soft condition, give way and dilate, ("adhuc sollicitus de aneurismate avertendo, subovatam laminam quando metallicam diu gestandum lausit, ut sic recens nimisque mollis tunc adhuc arteriæ cicatrix, donec probe induretur, compressa servetur.") He imagined even a wound of the great femoral artery to be healed by compression. He imagined the wounded part of the artery to have a cicatrix too soft and delicate to bear the current of the arterial blood! He imagined that it was necessary to guard against such dilatation, by an oval compress of metal, bound upon the thigh with a leather belt; and worn, as we find by this particular patient, for life.

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* Unanimiter cutis incisionem et arteriæ constrictionem commendavimus. Operatio sane ab actoribus magis commendatum et laudatum quam institutam; quod dicere non gravior, quia viginti abhinc annis et quod excurrit, in hac vasta civitate, ad quam sine numero confluunt afflicti, hanc operationem in arteria adeo ingenti nullus quantum noverim chirurgorum instituit.—Ruisch, p. 5.

At last they ventured to open the aneurismal tumor, and clear the sac of blood; but it was not for the purpose of performing the radical operation; they did not venture to follow the Arabian practice of tying the main artery, and cutting it across, so as to let it shrink into the flesh. Their doctrine of dilatation was still inviolate; and they stuck to their practice of compression; they cleared away the blood, sought out the wound of the artery, clapped a pellet of chewed paper upon it, and piled compresses upon this first compress of chewed paper. Thus they believed that they cured the wound in the artery by adhesion; and, when this method failed, they were so fearful of interrupting the main trunk of the artery, that rather than tie it they scrupled not to cut off the arm or thigh as their last resource*.

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* Our own great surgeon, Wiseman, seems to have been the only one who was bold enough, or sufficiently accustomed to dissection and actual operations, to withstand this favourite doctrine of true and false aneurisms. He alone thinks and judges for himself. He speaks from his experience in operations. He contradicts it flatly. He says, "This I was taught myself, and some while believed; but not having been able by my practice to discover one aneurism made by dilatation or relaxation of the outward coat, I am apt to

We cannot pretend to say what are the expectations of modern surgeons in respect to this reunion of the lips of a wounded artery; but if we may judge from books, the doctrines of true, false, and mixed aneurisms are in full force at this present day. There are many weak men ready to believe, that the aneurism which follows bleeding arises merely from a wound of the external coat of the artery; and there are many truly great men who believe, that the absolute wound of an artery may be united by compression: we find even Dessault, the celebrated Dessault, healing wounds of the brachial artery with pellets of chewed paper. The recovery of a limb, whose main artery is wounded, is still reckoned doubtful; and surgeons, fearful lest the inosculations of the articular or collateral arteries should not be sufficient to save a limb, are to this very day anxious to discover some new operation by which the wounded artery may be cured, and its canal preserved pervious. The late Mr. Lambert ventured to perform the operation of the hare-lip suture upon a wounded brachial artery; and I confess that I was so imprudent as to repeat this experiment myself; but this honest avowal of my ill success will, I hope, be esteemed a sufficient compensation for any rashness I may be thought

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believe there is no such thing, but that it takes its rise from blood bursting quite through the artery into the interstices of the muscles, where it raiseth a tumor suitable to the cavity, growing bigger or less, of this or that shape, as the muscles give way. But this tumor consists of blood extravasated, the artery lying undilated the while. I do therefore suspect the possibility of an aneurism by the dilatation of the outward or softer coat of the artery; because it seems improbable that a force big enough to burst the inward coat, which is so tough and firm, should leave the exterior, being softer and weaker, whole, and go out so leisurely into it as to give it time for dilatation. Those which I have met with did all *come from downright eruption through both the coats.*"

guilty of; and let it be remembered, in extenuation, that this operation had been boldly proclaimed successful*.

We may venture to affirm, that nothing has been more unfavourable to the improvement of our science than this traditionary nonsense, delivered down from one system to another, passing from hand to hand, among formal book-makers, "unum alterum insequentes sicut grues†;" who fly all in a row like geese. This imaginary wound of the external tunics, with dilatation of the inward coat of an artery; these scholastic distinctions, of true, false, and mixed aneurisms; these uncertain reports, about curing aneurisms by compression; and this vain expectation, of healing a wounded artery, by reuniting the lips of the wound, have not as yet been replaced by any true pathology of a wounded artery.

OF THE WOUND MADE BY THE LANCET.

First, It must be observed, that an artery is not pricked merely in its external coat; and the proof is this:—Our legislature does not prevent the most ignorant from meddling with a profession, which should be sacred as the priesthood,—masons, butchers, gardeners, cow-herds! are among the chief phlebotomists in this country; and it is to them that we are indebted for the various specimens of aneurism. They use very blunt lancets; and a blunt lancet being pushed rudely onwards, starts through the skin at last, and strikes deep into the arm. The aneurism is generally produced by a very large and rude wound, like that which the point of a penknife would make. I have seen many such aneurisms, and operated on several; once, when the operation was performed by another gentleman, I saw the artery so wounded, that it was held together merely by a tag; the cut in it was indeed oblique, but so large that it had severed the artery almost entirely across. In an operation which I performed myself, I proposed using only one ligature, being well assured that a single ligature, applied round the wounded part of the artery, would obliterate the artery to a considerable extent, above and below; but, upon opening the sac, I found the slit in the artery so very long, that I was forced to apply two ligatures in the usual way. In another operation, I found the great artery running over the fore part of the tumor, and beating strongly; I ventured to prognosticate, that, upon opening this aneurism, we should find either the brachial artery dividing high in the arm, or the artery so transfixed as to allow the blood to pass all out by the back of the artery; and accordingly, upon opening the arm, we found the artery entirely transfixed! When I passed my probe into the artery, it passed through the other side, and the artery hung suspended over the probe. The artery had been transfixed with a terrible gash; the pressure of the compress and bandage had hindered the blood from coming out from the greater wound on the fore part of the artery; it had all gone out from the smaller wound on the back of the artery; the blood, of course, was collected behind it, and the artery was so raised upon the fore part of the tumor, and so presented to the operator's knife, that, had the aneurism been opened rashly, it must have been cut across. From these descriptions, and the difficulty of stemming the blood at the time of the accident, and the rudeness of the people by whom this fault of striking the artery is committed, we have reason to believe that it is wounded always with a very rude gash, and sometimes absolutely cut across.

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* I shall have occasion to mention this operation presently.

† Guy de Chauliac.

[The fact undoubtedly is, that the wound of an artery presents this large and rugged opening; and of this I can exhibit many specimens; but it does not follow that the whole extent of the wound is directly caused by the point of the lancet, since I believe the coats turn up to a greater extent than that of the original cut. The artery may be torn in a certain degree, as the heart is in a very remarkable manner. A man put a small pocket pistol to his left breast, and shot himself through the heart; but the heart was rent from the base to the apex, by a bullet smaller than the tip of the little finger! *]

Among surgical writers, I find frequent and undeniable proofs of the fact which I have here affirmed, that the artery is largely opened. I have observed, that, in proportion to the largeness of the wound, is the size of the aneurismal tumor; I have never observed any aneurism increase so rapidly as to threaten bursting, except those in which the wound of the lancet was singularly large. We have few cases of aneurism absolutely bursting, except those related by Ruisch and Saviard; in the one the artery was entirely burst by a violent exertion of the arm; in the other (in Ruisch's, I mean) it was cut across with the lancet. And in this case mentioned by Ruisch, the aneurism appeared at first no bigger than a large pea, (so firmly do the parts resist the artery even

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* Commentary by Mr. C. Bell.

when it is wounded); but it grew sensibly from day to day till it burst at last, (so powerfully does the artery act when largely wounded). That this artery was largely wounded we must presume from the narrative which follows the case; for the surgeons having stopped the immediate flux of blood with bovista and compresses, proceeded then to their radical operation of tying the artery; and, upon making the incision, and scooping out the blood, the blood flowed from two separate points; by which it would appear that the artery had been absolutely cut across: ("Multum cruoris per vulnus aneurismatis expressit, et porro brachium secundum longitudinem sat profunde incidit, ut sanguinem coagulatum levi compressione facta auferret, et gangrenæ eo commodius opem ferret. *Hoc facta incisione*, sanguis arteriosus, *duobus e locis*, magna vi erupit,"—Ruisch.) In short, the fact is so plainly affirmed in this paragraph, that unless we are to suppose such a surgeon as Adrianus, assisted by such a counsellor as Ruisch, to have gone to work so very unskilfully, as to have cut the brachial artery across during the operation with the knife, we must allow the artery to have been entirely divided by the lancet.

The celebrated Guattani considers a false aneurism, or, in other words, a true wound of the artery, as a rare accident; he, as well as the older surgeons, explain the aneurism arising from the puncture of the lancet, as arising "from a wound of two or more of the five coats of which an artery is composed; the internal coat being, of course, no longer able to sustain the impetus of the blood; and yet we find in the book of Guattani a wound of the brachial artery as deep as can be imagined, the artery certainly transfixed, and the case resembling, in all its essential circumstances, that which I have just mentioned. "In one patient," says Guattani, "I found the arm so crooked, and with such an inveterate rigidity of the biceps, both from the posture of the arm, and the incessant application of strong spirituous fomentations, that there was no extending the arm so as to get at the artery to tie it, nor any way of saving the patient but by cutting off his arm, which I did upon the 27th day, assisted by the celebrated Pietro Javina. Having got the arm carried home, we proceeded to examine it, and happily discovered the cause of this singular difficulty, both in finding and in tying the artery; for the artery, far from lying in its natural situation, was entirely displaced by the extravasated blood, which raised up the whole bend of the arm in the form of a tumor, and pressed the trunk of the artery so before it as to lay it close against the internal surface of the skin."

This was surely a case similar to that which I have just described. The artery had been not merely wounded, but quite transfixed with the lancet; the blood had been poured out upon the back part of the artery; the artery had been raised over the fore part of the tumor, and had lain immediately under the skin. I conclude, also, that this was one of the most favourable cases for operation; for the wound of the artery was so wide, the artery was so far displaced from its proper situation, it was so stretched over the surface of the tumor, and so flattened by pressure, betwixt the tumor and the skin, that it could be of no use in nourishing the arm; the arm then was nourished chiefly by its inosculating branches; and this I am entitled to affirm, from having observed, that where there is little blood passing in the main trunk of the artery, there is much circulating in the collateral arteries; that wherever the trunk of the artery has been deeply wounded, the pulse has been proportionably weak before operation, and has returned immediately after the artery was tied. In one case only have I seen blood run from the lower end of the divided artery; and in that case the artery was very nearly divided across*. This is one of the many cases in which the arm has been very rashly cut off, and this pricking of the artery, with a wound of its outer coat only, is an imaginary accident.

WE CANNOT REPRESS THE BLOOD OF AN ANEURISM.

Secondly, It is not less imaginary, that the blood can be pushed back from the aneurismal bag into the artery! there is no such thing, it is a mere delusion; there is one case only, viz. the aneurismal varix, where this can be done. The aneurismal varix is a complicated aneurism, where the artery and vein, being both wounded, have not healed apart, but have adhered, a free communication being formed betwixt the artery and vein; the vein is dilated by the pulsations of the artery, the blood is still circulating and fluid; it may be pushed onwards in the veins, and might be pressed back into the artery. When this kind of aneurism is emptied, the artery is perceptibly felt filling the bag with a distinct pulsation, and a sort of whizzing noise; but in the proper aneurism no such thing can happen; the blood is firmly coagulated. I never found, in an aneurism of six weeks' standing, any fluid blood! It was all grumous and lumpy; and the clots which obstruct the mouth of the artery were peculiarly firm. It does not appear to me that the aneurism of the arm distends regularly and gradually, but, like a bleeding artery, it bursts out from time to time with an internal hæmorrhagy.

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* The rigidity which (in this case of Ruisch's) was attributed to the astringency of the spirituous embrocations, was owing merely to the tenseness of the fascia; for the whole of the bend of the arm was raised into a tumor.

[I have dissected both kinds of aneurism,—the aneurism by puncture of the artery at the bend of the arm, and the varicose aneurism of the same part; and I find these ideas quite correct. Moreover, we have in the varicose aneurism a confirmation of what has been stated, that the blood does not coagulate while it is contained within the natural surfaces of the blood vessels; for although the median vein be greatly enlarged in the varicose aneurism, there is no coagulum forms within it; whereas the very reverse takes place the instant that the blood escapes from the artery into the cellular substance*.]

Aneurism is more frequent among the lower ranks, especially among labourers. A poor man having refrained from labour for a week or more, is tempted to begin work again for the support of his family; he works for a day or two, the tumor is perceptibly enlarged after each exertion; the blood is then evacuated into the cellular substance, by successive internal hæmorrhages; till, at the end of six weeks, or two months, the arm is quite benumbed by the compression of this accumulating and condensed blood, and the operation is submitted to; but the blood thus successively effused is firmly coagulated, and we find the particular clot, which closes the slit in the artery, as firm as the gizzard of a fowl. I conclude, that we cannot reduce the blood of an aneurismal tumor;—first, Because it is coagulated; secondly, Because the wound of the artery is slit-like, and acts like a valve; thirdly, Because if we did press the blood back into the artery, we should feel the bag in some slight degree flaccid, and should feel the action of the artery when it filled the tumor again; fourthly, Because I have noticed, that in those very aneurisms, where many gentlemen in consultation declared, that, by pressing long and dexterously, they had reduced the size of the tumor, upon opening the aneurism, I have found the whole contents of the tumor grumous, without one particle of blood in the aneurism fluid enough to be returned into the artery, although the opening had been quite favourable to the receiving of it; fifthly, I do not think the pulse at the wrist could be so firm as we often feel it, unless the artery were perfectly closed by that particular clot, which plugs up the slit; and that again kept firm, by the general pressure of the grumous blood behind it. I do not then reckon the returning of the blood into the artery among the signs of aneurism, whether old or recent; the appearance is a mere deception. Every surgeon must recollect, that, by pressing firmly upon any tumor, he can sink it into the cellular substance, and reduce its apparent size; and it is particularly easy, by pressure and working, to flatten an aneurismal tumor; for pressure drives the blood more widely into the surrounding cellular substance, flattens the tumor for a moment, and seems to reduce its size; while, by working the blood aside, it really makes room for more extravasation, and increases the size of the aneurism. Of this I have seen some very imprudent examples.

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* Commentary by Mr. C. Bell

THE WOUND IS CALLOUS AND WILL NOT HEAL.

Thirdly, It is not less imaginary, that such a wound could heal by adhesion, so as to preserve the continuity of the arterial canal; for the arterial coats are, in their nature, hard, unyielding, and callous; a clot is usually interposed betwixt the lips of the wound; the blood runs freely along the canal of the artery, ready to flow through the slit upon the slightest exertion of the arm, or slightest motion of the clot; and there lies a considerable collection of blood betwixt the wound of the artery and any compress that we can apply!

And when, after the aneurism has lasted some weeks, we perform the operation, and open the tumor its whole length, we find the opening of the artery with inverted edges, if the slit be as large as I have generally seen it; or, if it be small, it is like a pie-hole; or, as the late Professor Monro describes it, very happily, " it is like a hole struck in a piece of leather with a punch *."

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* When the wound of the artery is small, and the aneurism is formed, the lips of the wound in the artery heal; it is this which gives the circular appearance to the orifice, which is well described a hundred years ago by Wiseman. He relates the case of a man whose artery was wounded in bleeding. He had applied a laced glove and sheath for the arm, in hopes of lessening the tumor and pushing back the blood into the artery, and he had in some degree succeeded; but the patient grew weary of these methods of cure, and " gave ear to every prattle, and fell into the hands of an empiric, who, while he tried to cure it with herbs, &c. so softened the tumor, that he made way for the blood to burst forth abundantly. The surgeons who were first called made a shift to stop the blood,

Yet Mr. Lambert of Newcastle, notwithstanding this callosity of the artery, ventured to expect success in sewing those callous lips together, and he succeeded. I performed the same operation, and failed; I opened the aneurism, hooked out the clots of blood, and then raised the artery upon my forefinger; I took next a very fine bleeding lancet, and scarified the two lips of the wound; after having made them raw, I passed a very delicate glover's needle through both the lips of the wounded artery, and twisted a fine cambric thread round the needle, so as to draw the lips of the wound close. Upon letting go the tourniquet, the artery was seen beating in the bottom of the wound; the pulse in the wrist became instantly as strong as in the other hand; indeed we thought this artery beat rather more powerfully. Every thing went on well till the twelfth day; on that day I was obliged to go out of town; a dangerous hæmorrhagy came on in the evening. On the fourteenth day the bleeding returned; I was still out of town, and the artery was tied with the two ligatures, as usual, by the late Dr. Aitken. It was insinuated, that had I been with my own patient the operation might still have succeeded; but I am sure it failed from natural causes, and that whatever faults might be imputed to the late Dr. Aitken, want of enthusiasm in his profession was not among the number; I know he would have been delighted to

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but the arm gangrened; they cut it off. Wiseman went to see it amputated. After amputation they slit up the arm, and laid the artery bare; it retained its natural shape and smallness, not one jot dilated; nor was the apercion considerable which had been made by that accident, but, by reason of its constitution, continued open, as I have seen a hole punched in leather."—Wiseman, page 126.

see me succeed, and he actually assisted me in the operation with a degree of zeal which was very honourable to him*.

I was, happily for my own ease of mind, not aware of the dangerous situation of my patient for those fourteen days: but, now that we are aware of this danger! sensible that the patient, if not carefully watched for a fortnight, may die in a moment of time! who will venture to repeat the experiment? Besides, we are now so little apprehensive of gangrene, from want of circulation, that our motives for repeating this dangerous operation are very slight indeed.

COMPRESSION OBLITERATES THE CANAL OF THE ARTERY.

Fourthly, That the old operation of compressing the artery did not cure by reuniting the wound, and preserving the canal of the artery, is to me very clearly proved by the manner in which they achieved this tedious cure. To satisfy you that I argue correctly, I will state to you one of the most remarkable and best authenticated cases of this kind that stands upon record. At the very time when all the surgeons in Europe had begun to take a particular interest in this disease, while they were still fearful of

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[* This operation was performed by my brother at a very early period of his professional life, and before he had conceived those juster notions of pathology which are enforced in this volume. The attempt was vain. As we are bound to believe that it had succeeded in other cases, we are left to presume that the operation had entirely closed the caliber of the artery; and that, in fact, the success was owing to circumstances neither foreseen nor understood.]—C. Bell.

gangrene, and anxious to have some absolute proof of the disease being curable by compression, it happened that Bourdelot, physician to the Queen of Sweden, was struck in the brachial artery.

"My artery," says Bourdelot, "was pricked, in the bend of the arm, where it runs under the median vein, though I had at the time remarked to the surgeon the pulsation of the artery, and advised him against bleeding there. When I saw the blood fly, per saltum, I applied graduated compresses, and kept quiet for some time: the outward wound, indeed, soon healed; but in no long space I perceived a small tubercle rising, which increased in spite of my endeavours to repress it. I now was convinced that styptics could not penetrate the skin, for thick compresses dipped in styptics had been of no use.

"The aneurism attained the size of a small hen's egg; but I accomplished the cure in the course of a year, by applying a round compress, bound firmly down upon the aneurism with thongs, which turned round the elbow above and below, and were adapted to any requisite degree of compression by holes in the straps, which hooked upon small buttons. The scutum was pressed deep down upon the artery, while the blood was allowed to pass along the veins towards the heart, by the sides of the compress, (in the angles made by the straps of the bandage with the cushion). The fretting of the compress I obviated by dipping it from time to time in a solution of alum in salt water.

"There remained not in my arm the smallest mark of the tumor; but for two years I was sensible of a degree of constriction round the wound, and along the course of the artery. The hardness I thought never would have disappeared, for the artery had acquired a solid and tendinous firmness; but that also was in due time entirely discussed, not leaving even the mark of a scar; and though the shield or compress left a sort of hollow in the bend of the arm, that also, in the course of a few months, disappeared. The dilated arteries and veins, which supplied the place of the main artery, contracted again as soon as the compress was removed, and the blood allowed to flow in its usual channel."

This case contains in it every possible argument against the conclusion which it was meant to establish. We may here observe, that it is not so easy as was imagined to heal the wound in an artery, even in the most favourable circumstances; for Bourdelot, the moment his artery was wounded, was fully sensible of what had happened to him; he instantly applied his compress and bandage, with all the precaution which an interest in his own situation, and the fear of a disease, much dreaded in those days, could suggest. There would, I dare say, be no slackness there! nor any want of attention to the state of the bandage! yet he could not oppose the artery, he could not heal this wound even when it was recent, the lips just divided, and the parts not yet injected with blood!

But perhaps, after having got the proper bandage made, he may have prevailed so far as to heal the artery? This I think still less probable; for when he began to apply the proper bandage, the aneurism was fully formed, and a week, or rather a fortnight, had elapsed from the time of the wound, before he applied his scutum or compress, so that the lips of the wounded artery must have become callous; besides a tumor as large as a pullet's egg was then interposed betwixt his compress and the artery;—"he supposes the blood to be gradually pressed back from the bag into the artery, the bag yielding before the compress like a sponge, and emptying its blood into the artery." Even granting this hypothesis, we must presume a long time to have elapsed before the edges of this wounded artery could have come into contact, by which time they must have healed apart! and have been past all chance or possibility of adhering together.

Since, then, his machine could not reunite the artery, and yet did actually cure the aneurism, the next important question is, How and by what natural process was the cure achieved? Let it be observed, that this tumor was many months of disappearing, or even of lessening; that an aneurism is one of the most firm and solid of all tumors, being hard crammed with coagulated blood. Such tumor, then, is pressed against the artery, the artery is flattened betwixt the tumor and the bone, the circulation in the main channel is interrupted, and the collateral channels are enlarged till they become able to support the arm, and supply it with blood; when these lesser arteries are so enlarged, and rendered active, as to work the blood forwards, it not only forsakes the main trunk, but has a tendency to continue in this new rout! The main artery is forsaken of the blood, its sides are kept in close contact, they adhere to each other, and the artery becomes, like the hypogastric arteries or umbilical vein, a firm cord.

This is truly the operation which they performed with their compresses. We have every proof we could desire of the process being complete in this case, for we find Mr. Bourdelot remarking, that the artery in his arm had acquired a degree of solid and tendinous hardness, never to be discussed, as he believed:—" Duritiem nunquam cessuram credidi; arteria enim substantiam obtineat nerveam et solidam," &c.

I am persuaded these old physicians accomplished with their compress exactly the same operation that we perform with the needle; they obliterated the canal of the artery; and, had they understood the pathology of this disease, or the effect of their own operations, they would have been able, I am persuaded, to have described to us the period of coldness and of interrupted pulse, and the manner of its return, just as distinctly in their operation by compression as in ours by incision; and certainly, had they succeeded as they imagined they did, viz. by discussing the tumor and healing the wounded artery, they would have told us, in place of this duritiem nerveam et solidam, how the pulse was felt in the bending of the arm as distinctly after the cure as before the artery was wounded. They would have compressed the artery only till they had obliterated it; and then have left the absorption to nature, but would not surely have continued this severe bandage for years*.

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* " We cannot help being surprised to find even the celebrated Dessault, after having cured a little girl of aneurism by compression, say not one word about the obliteration of the artery, nor yet mention its remaining pervious, a fact which he might have easily ascertained; for the girl was six years old at the time of the artery being wounded with the lancet; she wore the compressing bandage for a year! and she was fifteen years old at the time of writing the case!"—Vid. Journal de Chirurgie, page 37, Vol. II.

PELLETS OF CHEWED PAPER APPLIED TO THE OPEN ARTERY DO NOT HEAL BUT OBLITERATE IT.

Fifthly, When, long ago, every surgeon was in the practice, after opening the aneurism, of closing the wound in the artery with a pellet of chewed paper, is it likely that the lips of the wounded artery were made to adhere? Having myself failed in reuniting the lips of a wounded artery, I am very little inclined to believe that a rude pellet of chewed paper, graduated compresses, and a firm bandage over all, could do any thing but obliterate the canal of the artery. We do, indeed, find Garengeot describing, with all imaginable confidence, the appearance of the artery at the point where the wound of it was healed up by the chewed paper; but I believe he was just making that experiment on the credulity of his reader, which cost him less, perhaps, than most other authors. He wished to say to his reader, "You will, as soon as the compress falls off, see distinctly the cicatrix of the united artery!" but, with all his effrontery, he could not bring himself to this. He says only, "As soon as the lint and the pellet of chewed paper fall off from the artery, you will remark a white space where the beating of the artery is more intense! that is the very place where the wound was, and you must not leave it uncovered for a moment, but put a large compress upon it, powdered with rosin and whatever else may promote the generation of flesh round the artery."

Garengeot is an author in whom we can have no confidence; we find him writing by mere conjecture about many interesting points of pathology: but there is a more respectable author, Mr. Morrand, who also believed that he cured arteries by compression. He was in the practice of opening the aneurism, and of putting down a piece of sponge or agaric upon the wounded part of the artery, heaping compresses above the agaric, and binding the whole very firm with rollers. Speaking of one particular case, he says, that he cured an artery wounded with the lancet in a manner very different from that where the ligature is used. "I need not," says Mr. Morrand, "mention the several precautions which I took after applying Mr. Brossard's agaric to the artery. I shall only observe, that the pulse, which was interrupted for twenty hours, returned at the end of that time, and that I cicatrized the wound in a month." "Je dirai seulement que le poulx interceptè a la main pendant environ vingt heures, se manifesta au bout de ce temps la," &c.—p. 168.

All those surgeons who have used the compress, sponge, or agaric, believed that they healed the wound of the artery; but you, I dare say, have a more correct idea of what Mr. Morrand was doing with his puff-ball, and what this interruption of the pulse means. He had entirely compressed the artery, laid its sides in contact, and obliterated its canal; the pulse was for twenty-four hours interrupted, the collateral arteries were enlarged, the pulse returned; the operation, in short, was essentially the same with that of tying the artery*. This gentleman, whose artery Mr. Morrand thought he had healed by pressing a piece of agaric upon it, had the artery wounded with a sword, a kind of wound which could not be easily cured by the reunion of its lips. But we find in Morrand's paper a still more decisive fact than this :—" He had cured two others of aneurisms in the arm, by applying a bit of agaric to the wounded artery; and in those two cases the pulse did not return in one till the fifteenth, nor in the other till the seventeenth day." An artery completely flattened and compressed for seventeen days, certainly was not healed but obliterated.

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* We find, in the following transcript from Murray, two very singular things:—In the first place, We find two patients allowed to die of bleeding, during the night, after some awkward attempt by the surgeons of the hospital at curing the aneurism of the arm, in which, according to the oldest fashion, they had tried compression not above the skin, with the hopes of saving their patients from the

So little did these old surgeons understand the effect of their compresses, that they imagined that their success depended much upon the astringency of the liquor in which the compresses were dipped, and their astringent liquor was usually a diluted

pains and horror of a bloody operation, but had first cut up the aneurismal tumor, and then, instead of tying the artery with a ligature, had applied a compress, and applied it so insecurely, that both the patients, from some unwary motion in sleep, had bled to death during the night. This is his fact; and his opinion, as it is plainly implied in the following words, is very curious. " If your compression be too powerful, in place of saving the artery, you will absolutely obliterate the artery; but if you compress lightly, with the design of saving the artery, you are never out of danger of an alarming, or even fatal hæmorrhagy." This language very clearly implies that Murray, like most others, expects from compression, not an obliteration of the artery, but thinks, as Heister did long ago, and Mr. Morrand more lately, (Vid. Acad. des Sciences, Vol. V. p. 172, octavo) that the compress, by suppressing the quick motion of the artery, heals the wound.

Murray speaks thus : " Frustra itaque, si firmam compressionem instituimus, conservationem arteriæ expectamus, in leviore autem, qualis ad scopum obtinendum requiritur, hæmorrhagiæ repetitæ quæ chirurgi animum quam maxime sollicitant, atque etiam ægrum ad ultimam sæpe metam detrudunt, vix evitari possunt; leviori sub somno, motu brachii, quo compressio aliquantum fuit perturbata, binos ægros Montispessulani vigesimo post operationem die, hæmorrhagia exitiali correptos fuisse, narravit cel. Præses, (viz. Murray.")—Vid. Arvidson Murray, p. 20.

caustic! Webber applied butter of antimony to the wound of the artery in aneurism of the arm; and Garengeot trusted not so much to his compress of chewed paper as to the liquor he dipped it in, which was not a mere astringent; it was a caustic, and a quackish one, which he had the meanness to conceal, (" Pour cet effet les operateurs d'aujourd'hui se *servent du caustique*, ou de la ligature. Si l'on prend le parti du caustique, voici la pratique la mieux reçue. D'abord que l'ouverture de l'artére est bien découverte, je prens un morceau de papier brouillard mâché et exprimé; je le trempe ensuite dans *un caustique liquide, que je préfere à tous les autres caustiques;* je l'exprime fortement, de peur," &c.—Garengeot, p. 246.) And Asman plainly recommends buttons of vitriol to be applied to the wound in the artery. (" Imponantur vulneri globuli pisi magnitudinis ex vitriolo Cyprino ad albedinem calcinato gossyppio probe involuti. Globulos vulneri arteriæ proximos tamdiu relinquendos esse donec sponte decidant.") Thus we perceive, not only that naked buttons of vitriol were applied to the wound of the artery, but kept there till they produced sloughs. What could actual caustics like these do but obliterate the artery by inflammation, or destroy it?

Sixthly, There is just one moment of time * in which it is possible to succeed in reuniting a wounded artery, and it is the very case in which Bourdelot failed. In a recent wound, where the surgeon is sensible of the artery being wounded, it is possible to heal the artery before the aneurism is formed, before any tumor of blood is interposed betwixt the compress and the artery, before the cellular substance is crammed with blood, or separated from that artery which it should support and assist in its adhesion. That an artery in the moment of being wounded may be made to reunite, I hold to be an absolute fact, not because it is proved by the authority of those who have prevented aneurisms by a skilful compress; for in such cases, the aneurism being prevented, we still are left in doubt whether the artery was actually wounded! but the aneurismal varix ascertains the fact.

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* For the purpose of compressing a wounded artery, the older surgeons usually put into the folds of their first compress a piece of money, a split bean with the convex side towards the artery, a peach stone, the half of a walnut shell, &c.

The Aneurismal Varix is a disease produced after bleeding with the lancet, by the close union of the wound of the artery with the wound of the vein, and the blood of the vein rushing into the artery through this side passage distends it. I would trace, in the following order, the several forms which a wounded artery assumes:—First, It generally happens, after any accident of this kind, that the compression which the surgeon makes, while it prevents the outward bleeding, is not sufficient entirely to subdue the action of the artery, which bleeds inwardly! the blood is then poured out under the fascia! the holes or lancet wounds in both sides of the vein (through which the artery was struck) heal! the blood is extravasated under the fascia, and the fascia, by its great strength and tension, resists the effusion, so that it takes place very slowly: It is thus, that, in about a month or six weeks, the common aneurism of the arm is formed, having for its external coat the thick fascia of the biceps muscle.

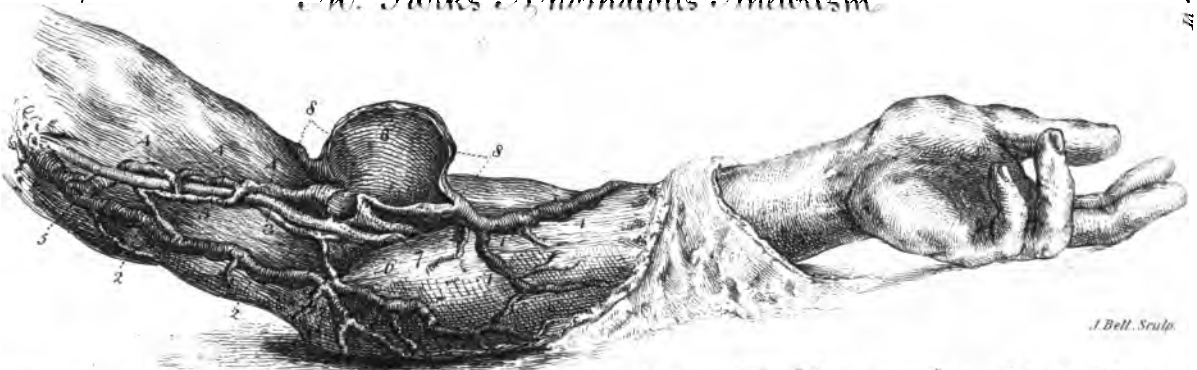
Secondly, It sometimes happens, that the pressure made by the surgeon at the time of the accident is so steady as to produce an adhesion of the wounded lips of the artery with the wound of the fascia; then the disease does not appear in its proper form; there is no resistance from the fascia; the artery does not eject its blood slowly into the cellular substance under the fascia, but drives it freely under the common cellular substance of the skin; the regular form of the disease, the circumscribed tumor, is wanting; and the whole arm from the shoulder to the wrist is black with extravasated blood, as if mortified.

Thirdly, It often happens, that the pressure is still more correct, steady, and well supported, and the vein on the outside of the fascia is kept in close contact with the fascia; while the wounded artery within the fascia is kept in close contact with its inner surface! the artery unites with the inner surface of the fascia, the vein unites with its external surface; and a lateral communication being thus established betwixt the artery and vein, the vein is dilated by the force of the artery into a varix, which, from the nature of its connexion with the artery, is named Aneurismal Varix. In this disease, the blood passes so easily into the vein, that little blood goes downwards along the artery; the arm below is impoverished of blood, and is greatly weakened; the dilatation of the vein increases almost to bursting; and as the vein and artery, though they run parallel, are not in contact with each other, but are separated by the sheet of tendon named the fascia, the communication betwixt the vein and artery comes to be of considerable length; by emptying the dilated vein, and pinching with your fingers and thumb, you can distinctly feel the communication betwixt them.

Fourthly, The artery, where it lies within the fascia, is surrounded with a set of small concomitant veins, which, from their encircling the artery, are named Venæ Comites, or Satellites. These also are sometimes struck with the lancet; and, by continued pressure, the artery, the internal vein, the fascia, and the external vein, are all massed together with a considerable degree of confusion, and thickening of parts. But however confused the other appearances may be in such a case, this circumstance will distinctly mark the nature of the disease,—that, in performing the operation (as there are two veins and one artery united by adhesion), the surgeon will find two successive sacs of blood, one under the other, with a small orifice of communication betwixt them. Perhaps the anomalous case related by Mr. Park of Liverpool was of this nature?

The young man, whose case Mr. Park describes, had been coarsely bled, was sensible at the time of being struck too deep in the arm, and felt more than ordinary pain. He presented himself three times successively at the Liverpool Infirmary. Even at the first this was marked as an anomalous disease, for there was a complication, as if of common aneurism with aneurismal varix. There lay immediately over the wounded artery, and receiving its pulsation, a small hard circumscribed tumor, no bigger than a walnut; and there accompanied this smaller tumor a considerable aneurismal dilatation of the basilic vein. He called a second time at the Hospital, and still the aneurismal tumor over the artery held itself distinct from the varicose dilatation of the vein. It

Mr Park's Anomalous Aneurism



J. Bell. Sculp.

11. Branches of the Median Vein
22. Branches of the Basilic Vein
3. 3 The Brachial Artery
4.4. The Vena Comites surrounding the Artery
5 Union of the Venæ comites with the Trunk of the Basilic Vein
6 The wounded artery
7 Dilatation of the Vena Comes
8 Dilatation of the Med. Cephal. Vein

London. Published 1826, by Thomas Tegg, 73, Cheapside.

was about a year after the disease began, that, having used too great freedoms with his arm, he was brought into the Infirmary a third time, with the arm greatly swelled, inflamed, and partly suppurated; and the tumor having burst during the night following his admission, there was a necessity for performing an operation, which, considering the anomalies of the case, the late hour at which the operation was performed, and that alarming loss of blood which made it necessary, must have been very unsatisfactory to Mr. Park. But he delivers this interesting case with singular modesty; and though, in making this operation known to the profession, he has, perhaps, done no more than his duty, yet he has done it in such a manner as to deserve our gratitude. It was remarked by Mr. Park, that in the time of the operation, after opening the first sac, he saw an orifice which seemed to him to be the orifice of the artery; but he found, upon introducing the probe, that it could not pass upwards nor downwards farther than half an inch. Upon opening this second sac, he found at the back of it a second opening, a small, round, circumscribed orifice, which led into the artery. The artery thus discovered was tied accordingly, and the operation finished.

In this case one of two things must have happened. The artery, the vena comes, the fascia, and the outward vein, must have all united together, being massed and thickened by inflammation; the ready communication of the vena comes with the outward vein may have saved the vena comes from dilatation; and the circumstance of the fascia covering the dilated part of the internal vein, (and adhering to it), may have given it peculiar firmness, and may account for the internal tumor being so small, (it was no bigger than a walnut); and farther, the frequent valves in this vena comes, or internal vein, may account for the limited dilatation of it, and for the probe not passing easily upwards or downwards. Or, on the other hand, the artery may have begun to form a proper aneurism among the cellular substance; the passage betwixt the fascia and the vein may have continued open; the blood may have made its way from the sac of this incipient aneurism into the vein; and, if so, the blood being thus conveyed away through the vein, the force would be taken off from the proper aneurismal sac, the cellular substance would be condensed into the form of a regular bag, that bag would be saved from further distension by its free communication with the vein, and the perpetual circulation of fresh blood, through it, would prevent the formation of clots, and would also prevent the tumor assuming the proper form of aneurism.

[* We have very few dissections of this kind of aneurism. I have carefully examined one, and it corresponds with the representation of Mr. Park. That is to say, the median vein is enlarged into a sac; a lesser sac is found under this larger one; and connected with this deeper and lesser sac is the surface of the artery. I found that in this case there had been a high bifurcation of the humeral artery, and both branches had assumed a size three times larger than natural. In the lesser sac of communication there was a small clot, as in a common aneurism, which conveys the notion to me that it was not formed by the dilatation of one of the vena comites, nor by the branch of communication betwixt the veins, but that it was a sac formed of the cellular membrane betwixt the artery and vein.]

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* Commentary on the Aneurismal Varix by Mr. C. Bell.

Now, these various adhesions sufficiently prove to me, that an artery may be healed; for if an artery can thus be made to adhere to the fascia and vein, so as to form an aneurismal varix, it may, by a firmer and steadier degree of compression, have its wounded lips reunited; and this seems to be the more probable, when we consider how these lips of the wounded artery are imbedded in cellular substance, actually wounded along with the artery, and ready at all times to swell and close the wound.

Thus, though I do not believe that an aneurism, perfectly formed, ever has been cured otherwise than by a total obliteration of that artery which produced it*, yet am I well satisfied, that, after a recent wound with the lancet, the generation of aneurism has been often prevented. The celebrated Brambilla recom-

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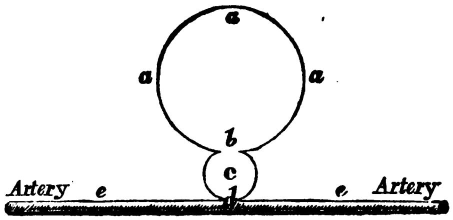
* In another chapter, some further views of this subject, as they relate to Natural Aneurism, will be explained.

Mr. Park gives the following plan of his own operation, and from it I have ventured to make the conjecture which I have delivered above. " A section of those cysts," says Mr. Park, " would exhibit some such appearance as this, (a a) The first or outer cyst, (b) The orifice leading into the second or deeper cyst, (c) At the bottom of which was seen the orifice (d) leading into the artery marked (e e)."



mends, as the surest of all compresses for immediately healing a wounded artery and preventing aneurism, the pellet of chewed paper, supported with graduated compresses and a firm bandage. The cure which Brambilla performs thus is not, like those of Bourdelot and Morrand, an obliteration of the canal of an artery, whose lips are become too callous to be reunited, but the reunion of an artery recently wounded, the wound of the artery itself fresh and raw, and the surrounding cellular substance also wounded and inflamed; not an obliteration by compression, gradually increased for the space of a year, but an immediate reunion, procured by the neat apposition and steady support of the wounded parts, continued for no longer than eight days*.

It is an anecdote in surgery, not unworthy of being related, that this wound of the artery is as frequent in Germany now as it was in France in those days when Dionis practised, and when the surgeons were, by law, obliged to pension those whose arms they had injured in bleeding. "In Germany," says a great surgical writer, "the phlegm has acquired a great reputation," but the harm it has done, while it has been acquiring reputation, is incalculable; for Brambilla says, "I have frequently been present when the young surgeon, having struck a vein with the fleam, (vena phlebotomo elastico incisa), has been unable to stop the bleeding; the young man being himself ignorant," says Brambilla, "of having wounded the artery, I have, to prevent alarm, tied up the arm myself. Upon leaving the house, I have asked the young man whether he was sensible of having wounded the artery? when suddenly, recollecting the decisive signs of a wounded artery, he has nearly fainted at the thought*."

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* Vulnere hac ratione deligato, membrum, per octo decemve dies, flexum quietumque tenendum est, quibus præterlapsis quod si fascia solvatur, arteriæ vulnus plerumque glutinatum deprehenditur.—Brambilla, page 93.

Brambilla adds, that innumerable accidents of this kind prove that wounds of the artery, especially in bleeding, may be easily healed †.

[‡ The ingenuity evinced in this chapter has not only gathered into a point the information of the time past, but has excited and directed others in their inquiries; a suite of experiments have been made, following up this subject, showing that a mere puncture of an artery with a round point, or with an instrument like a punch, will spontaneously heal when the experiment is made on the arteries of brutes.]

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[*] Contigit aliquando, ut me præsente juvenis chirurgus, vena phlebotomo elastico incisa, sanguine cohibendo haud sufficeret, utpote nescius arteriam læsam esse. Quin ægra rationem inspiceret aut aliquid auspicaretur, ipsemet ego deligationem modo superius exposito administravi, totamque curam perfeci. Cum vero egrediremur interrogavi juvenem illum chirurgum, nonne arteriæ vulnus inflictum esse animadverterit? at ille phænomenorum, sub operatione conspicuorum, nunc subito reminiscens, tanto terrore percellebatur, ut parum abfuerit quin animo deficisset."—Page 92.

[†] I am far from thinking that every case thus bandaged by the surgeon, and thus cured, has been a wounded artery. I am, on the contrary, persuaded, that often surgeons are mistaken, though, surely, Brambilla could not be deceived. I once saw a woman walk on foot from the north of Scotland, three hundred miles, to have some operation performed. A vein which had been opened bled so violently, that even the tourniquet could scarcely command it, and she left home under the impression that the artery was wounded; her own surgeon said so, and from the violence of the bleeding, every surgeon who had seen her in her way up to town had acknowledged that it could be nothing but the artery; at the end of every day's journey she had lost blood, so that you might almost have traced her; she was several times obliged to stop a day or two from mere weakness; it was, after all, nothing but a vein which had ulcerated, and would not heal; but it was easily obliterated by a firm pellet of paper, kept very firm for a few days.

[‡] Commentary by Mr. C. Bell.

OF THE CONDITION OF AN ARTERY WHEN TIED WITH LIGATURES.

These are my notions of the condition of a wounded artery; and we shall proceed next to investigate the state of the artery when actually tied with a ligature. This, far from being an idle speculation, is, I trust, an inquiry which will lead to very important conclusions; for we naturally inquire, first, How the artery (when tied, as in the operation of aneurism) is affected by the ligatures which are put round it? secondly, How the open artery of a stump is affected by the ligature with which it is tied? and this leads directly to a very interesting inquiry, viz. How the accidental bursting of arteries is to be prevented, and from what causes secondary hæmorrhagies arise?

An artery is part of the living system; it is indeed neither sensible, so as to convey, when injured, the sensation of pain, nor is it irritable, so as to contract like a muscle upon the application of ordinary stimuli from without; yet is it not the less a part of the living system, apt, when injured, to enter into a proportioned re-action. An artery has its vasa vasorum, its arteries, veins, and lymphatics, for the growth, support, and nourishment of its own coats. Its circulation and nourishment is according to the common laws of the system; and having this apparatus of active vessels, it is connected with the surrounding parts by the common cellular substance, by lesser arteries and veins, and the division of that cellular substance, or of the artery itself, is as much a wound as an incision in the skin is! By what laws, then, should we calculate the effect of ligatures on arteries? or by what analogies should we explain them, but by similar operations upon other parts of the body?

An artery tied with a ligature is like a polypus, whose root is tied by a ligature; the circulation in such polypus is interrupted; it shrinks, dies, and drops off in the course of a few days: Or an artery, as it is a hollow tube, may be more correctly resembled to a strangulated intestine; for the intestine is so compressed by the stricture of the ring, that the whole intestine is inflamed, the middle portion mortifies and sloughs off, while the two extremities where the intestine is immediately compressed by the stricture inflame, and adhere to the ring; and the hollow part of the intestinal tube would also be obliterated, but for the perpetual passage of fæces and flatus, and because there is not, as in the arterial system, any lateral passage by which the circulation of fæces through the rest of the intestinal canal could go on.

In performing the operation for aneurism of the arm, we usually apply two ligatures upon the artery, which include betwixt them about two inches of its length; one ligature is applied above the point where the artery is wounded, and one below; and both these ligatures come easily away on the eighth or tenth day, without our needing to cut the ring of the ligatures where they encircle the artery*. How is it that these ligatures come so easily away? How do they come away thus without the loop or ring of either of the ligatures being cut open? What becomes of the intercepted portion of the artery? What is the condition of these two points of the artery which were embraced by the ligatures? Surely it happens here, as in all other cases in which we apply a ligature, that the part affected by that ligature is necrosed, mortified, cut off from the system. In this operation of tying an aneurismal artery, first, the pulse ceases the moment the ligatures are drawn, a sign surely that the sides of the artery are fairly compressed against one another; secondly, the space of the artery (two inches, perhaps, in length) is so fairly intercepted by the two ligatures, that not only does the blood cease to pass along the canal of the artery, but the circulation in the vasa vasorum, in the nourishing vessels of the artery itself, ceases!—the intercepted piece is killed just as a polypus is by a ligature! The death of this intercepted piece prevents its supporting and continuing its connexion with the surrounding cellular substance, whence it happens, that of the arterial canal all that is intercepted between the ligatures dies; the cellular substance surrounding that portion of the artery suppurates, and the intercepted portion of the artery is as fairly cut out, as if it had been dissected away with the knife!—and as a polypus, when tied in a noose, fades on the second, and drops away on the third or fourth day, in like manner an artery, after being thus tied, decays, mixes with the purulent matter of the wound, and the ligatures become slack on the fourth, and may be drawn away on the eighth or tenth day. The two ends of the artery are meanwhile obliterated by adhesion of their opposite surfaces, so that before the ligatures slacken, this adhesion is strong enough to resist the impulse of the blood, and, indeed, if it were not for this part of the process, hæmorrhagy must always ensue whenever the ligatures were withdrawn. Mr. Petit, in support of his own doctrine, ventures to say, " that the ligature is insecure, because, if the ligature falls off before the clots become firm, the artery will bleed." But this premature falling off of the ligature, which he apprehended, cannot happen; the ligature will not even slacken before it have effectually done its business; or, in other words, one part of the artery will never be mortified and separated until the part above and below have been obliterated by adhesion, in consequence of the immediate pressure of the ligatures.

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* Let the reader observe, that this statement by my brother is an argument drawn from the practice which prevailed, not the announcement of a rule of practice. On the contrary, he was the first who tied the artery above the bend of the arm with a single ligature, in the aneurism from bleeding.—C. Bell.

This process then may be explained in few words. The ligatures applied round an artery operate by making the several points of the arterial canal pass through the several stages of inflammation, from adhesion in one point to gangrene in another. The space included betwixt the ligatures falls into gangrene; the space immediately under the stricture of each ligature adheres. This adhesion prevents the gangrene or the inflammation passing along the higher parts of the arterial canal; but the inflammation affects the arterial tube a little way upwards and downwards, so as to thicken its walls and contract its cavity, whence the canal of the artery is obliterated a little way beyond the exact place where it is tied. All this is proved by the reports of those very surgeons who continued theorizing about the contraction and straitening of the artery, after they were sensible that the internal surfaces of the artery adhered *.

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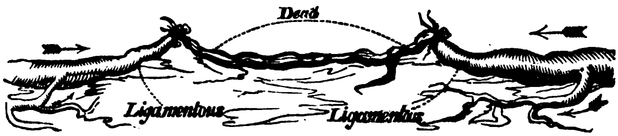
* We find the following account of this process in Kirkland, p. 5.—" An aneurism of the arm, being in great danger of bursting, obliged me to perform the operation; the impulse of the blood against the ligature, at the time of the operation, was very great; and as a part of the artery (whose diameter was considerably enlarged) was exposed, its pulsations were visible; but upon removing the dressings the third day afterwards, the pulsation could

PATHOLOGY OF AN ARTERY TIED WITH LIGATURES.



That arteries never bleed from the flat surface of an amputated stump, is still a more decisive proof of this doctrine. We pull out those arteries with the tenaculum or forceps, tie them with a small thread, and pull that thread away by the third or fourth day. No one will suppose, that, when the ligature is drawn away, such artery is prevented from bleeding by a clot stopping the mouth of the artery, as Mr. Petit imagined; nor that the canal of the artery is com-

neither be seen nor felt nearer to the ligature than an inch and a half; whence I was led to conclude, that the artery had *collapsed* and *gradually closed* itself up, to the nearest lateral branches."

I have observed after I had performed the operation for aneurism, that, on the third day, no pulse was to be felt at all in the wound; but I never considered this as in the least wonderful, seeing how very probable it is, that by that time the ligature must have cut across the artery, the artery must have shrunk, and its canal must be obliterated considerably beyond the place to which it has shrunk. But there is also another thing particular that Mr. Kirkland and Mr. White insinuate upon all occasions, that the artery is obliterated just up to the first inosculating branch, and always up to it. Mr. White says,—"In the arm I have by me, on which the operation for aneurism had been performed, it is plain to a demonstration by the injection, that the artery was closed, both above and below the ligature, to the next lateral branch."

His preparation was, at that time, the only one in existence; "but I have also by me" the preparation from the arm of a man who had formerly had the operation for aneurism performed upon him, and it is so particularly like Mr. White's, that were I to give a drawing of it, it would be thought to be a mere plagiarism; but in this very curious circumstance it differs, that the injection, though coarsely done, and in great hurry, has passed the great inosculation, (for in my preparation there is but one great inosculation to support the limb,) a full inch and a half, terminating in a blind sac.

pressed by the inflammation and thickening of the surrounding cellular substance, as alleged by Mr. Pouteau; for we draw out the artery and tie it quite clear of any cellular substance, or muscle, or adjacent nerve. The artery when tied thus, can be obliterated only by the adhesion of its internal surfaces; the part directly under the compression of the ligature unites by adhesion; the part below the ligature is destroyed like a polypus, fades and dies; and it is the fading of the lower part thus mortified, that allows the noose of the ligature to slip off on the third or fourth day.

[* I am forced to make some comment on this statement of the death of the coats intercepted in the double ligature of the artery in aneurism; and the mortification and dropping off of the artery tied on the face of the stump. The statement is correct, and the argument applicable to most cases; but, in matter of fact, the insulated portion of the artery does not always die; it does not necessarily mortify and slough.

I have preparations, which show that the ligature of the femoral artery after amputation, has come away, having effectually closed the artery, yet the portion of artery below the ligature is something more than one-fourth of an inch in length, and it had not been deadened. This is the cause of the unexpected phenomenon, when the ligature surrounds the artery. The simile of the polypus included in the noose is correct, so far, but with this difference, that the coagulable lymph, being effused from the surface of the open wound, covers the knot of the ligature, and forms a connexion betwixt the surface of the stump and the insulated portion of the artery by which that portion of the artery still lives; and the circle of the ligature and the knot are surrounded with this coagulum, which becomes vascular. When the ligature comes away, the portion of the artery below the noose remains alive. This fact I have ascertained, and cannot be deceived. It is what takes place when the stump inflames and adheres in the manner we most desire after amputation. But if, on the contrary, suppuration should take place, then if the face of the stump be foul, I think the portion of the artery below the noose of the ligature wastes away, and is thrown off with the secretions. To pursue the subject, when the operation of aneurism is performed with two ligatures, leaving an intermediate space of the artery separated from the surrounding cellular membrane, and terminated above and below by the ligatures, it is very natural to suppose that such portion of the artery must die and slough; and so, I have no doubt, it does generally. But if, instead of there being a large and suppurating wound, the operation is neatly performed, and the incision closed by adhesions, then there is not a sloughing of the artery as a necessary consequence; it may be surrounded with coagulable lymph, adhere, and live, and the ligatures may be brought away without any portion of the artery.

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* Commentary by Mr. C. Bell.

I beg to be understood, that in stating what takes place in this instance, I am not arguing for the propriety of using two ligatures in aneurism.

I may add, that I have in my collection the preparation of a humeral artery which very much resembles the sketch in page 312; but the intermediate portion is not dead; it is firm and ligamentous.]

The pathology of a tied artery is thus reduced to common principles. The obliteration and adhesion of a wounded artery, is truly compared with the reunion of any other wound; and one subject of inquiry alone remains, the most important, perhaps, in surgery,—What are the causes which prevent the adhesion and obliteration of an artery, and produce ulceration in its coats? for the causes which thus produce ulceration and prevent adhesion of the artery, occasion those secondary hæmorrhagies of which so many patients die. We never leave our patient bleeding, but it often happens, that in the course of a few days after aneurism or amputation, the blood bursts out suddenly, and the patient bleeds to death! Direct hæmorrhagy from a recent wound is easily suppressed, for we see the artery, and can tie it; but this secondary hæmorrhagy is peculiarly dangerous; it comes upon us when we are least aware, the parts are ulcerated, or mortified, and the bleeding artery is no longer to be found.

OF THE CAUSES OF SECONDARY HÆMORRHAGY; AND, FIRST, OF BURSTING OF THE ARTERY FROM THE DISEASED STATE OF ITS COATS.

The bursting of an artery after it seems securely tied, arises sometimes from the unfavourable state of the artery, and from its being incapable of adhesion, but much more frequently does it happen from that process which should terminate in adhesion of the artery, proceeding to inflammation, and ulceration of the arterial coats. The diseases of the arterial system have not been even slightly investigated! There are few people who have passed their grand climacteric without having the condition of the whole arterial system very remarkably changed. The extreme arteries, the active arteries, in all parts of the system, are less affected; they preserve their natural pliancy; but the great arteries, which serve but to conduct the blood, and whose contraction is less important to the existence of life, are remarkably affected. We are sensible, towards the decline of life, of changes in the great arterial trunks, plainly unfavourable to our operations; the cellular substance which joins the coats of the arteries is diseased; the whole tube is but ill disposed to pass through those changes which are familiar to the other soft parts. They do not adhere, inflame, thicken, and obliterate, as sound parts do. In dissecting an aged subject, we always find the arteries less pliant; sometimes they are contracted, sometimes enlarged; they become white, and their coats thickened and less connected with each other, so that they separate like the coats of an onion into ten or twelve, or into innumerable lamellæ; they are, at the same time, brittle and fragile, and have a crisped feel; they are sometimes ossified; they break, or crack, when we attempt to bend them; and the drawing of a ligature round such an artery tears it from want of pliancy. Our anatomical injections are successful only in very young subjects; while in older subjects the arteries burst because they have lost their strength, or tear under the necessary ligatures because they have lost their pliancy. The anatomist knows by the first touch of the femoral artery, for example, whether his subject will bear to be injected; and the surgeon, in like manner, often foresees, by the first touch of his finger, those burstings of the artery and secondary hæmorrhagies of which so many have died.

Thus it often happens that the artery, too hard to bear a ligature, breaks and tears across in the very moment of drawing the ligature; the artery must, no doubt, have been in this condition, which gave the celebrated Petit so much trouble and anxiety in the case of Mr. Seneuze, the bookseller. Mr. Petit having amputated this gentleman's thigh, found that the femoral artery was nothing affected, neither by the tourniquet nor by the ligature; and he was obliged in the end to suppress the hæmorrhagy by compresses piled upon the face of the stump, and braced down with very firm rollers. It must also have been an artery of this kind, by the bursting of which Mr. Acrell had almost lost his patient; for the artery did not stand the ligature one moment, but in a manner burst under his fingers. The case was as follows:—

"A soldier, of a scorbutic habit, extremely weak and convalescent, was stabbed, unfortunately, with a pointed knife in the femoral artery, about seven inches under Poupart's ligament, and the wound bled so furiously that he fainted. A physician, who was called, bound it up so effectually with compress and bandage, that he stopped the bleeding for twelve days, but the blood burst out again on the thirteenth day; notwithstanding which, the outward wound healed, the aneurismal tumor was distinctly formed, and by the twentieth day it beat very strongly, threatening rupture. Acrell, thinking the aneurism too large to be cured by compression, proposed to tie the artery; he opened the tumor; scooped, and washed out the very black and fœtid blood, and exposed the artery, which he found dilated for about four inches into a large sac of about three quarters of an inch in diameter. He then tied the artery with one ligature above, but, behold, while he was drawing the lower ligature, the artery suddenly burst above the upper ligature, and threw out its blood with such force, that in less than a minute the man had lost fully four pounds of blood." This artery tore under the pressure of the ligature; the tourniquet could not command the hæmorrhagy; the ligature itself was ineffectual. In these distressing circumstances, Acrell at last suppressed the hæmorrhagy by sponges and compression; with his sponges and compresses, he "filled up the whole cavity of the aneurism; and, to ensure a proper compression, he made a sheath for the thigh of white iron, with a globular compress upon its internal surface, adapted to the place of the wounded artery." Thus he accomplished the cure; and the case is a singular example of the artery in that very state which I have described, breaking under the ligature, giving way in the very moment of the operation.

[* The following occurrence took place under my observation, in the Middlesex Hospital. A man having suffered the operation for aneurism of ham, had gone on well for some days, when an oozing of blood took place from the wound. The house surgeon being called, he thought it necessary to apply the tourniquet. The hæmorrhagy was stopped, but in a few days there arose a tumor in the thigh which burst into the wound made in the operation, and he died of hæmorrhagy. The pressure of the tourniquet had burst or injured the coats of the artery in the groin, and hence arose a distinct aneurism. We cannot be surprised at such an occurrence, when we contemplate the state of the diseased artery on dissection; and it appears, that it not only cannot bear the ligature, but sometimes cannot bear the pressure of the tourniquet.]

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* Observation by Mr. C. Bell.

But besides being thus hard, and apt to break under a ligature, such artery is also callous, so as to be unapt to adhere; and thick in its walls, so that it is not easily compressed; and very often this unfavourable condition of the artery is rendered more dangerous by the awkward manner in which the ligature is applied. Thus the femoral artery having its walls thickened, its cellular substance unsound, its coats not closely connected, but rather apt to separate, the internal surfaces can never be neatly applied to each other, for in consequence of the great caliber of the artery, and of its cylindrical form, of the thickness of its coats, and of the want of pliancy of the whole tube, in place of flattening, when the surgeon applies his ligature, it is puckered and pursed up. Besides, I daily observe operators using ligatures for the femoral artery as thick as common tapes, the loops of which, when twisted and drawn in the form of a surgeon's knot, are actually larger than the arteries round which they are applied; so large, indeed, that it is impossible to draw them close*.

Mr. Duchamps, a French author, mentions one operation for aneurism, in which the surgeon actually could not draw his great ligature tight enough to suppress the bleeding, and from this cause alone he was forced to cut off the limb. An artery thus diseased is apt to tear under the ligature; or if it be strong enough to bear the ligature, by being callous, it fails to unite; the interruption which the ligature gives to the blood is mechanical only; no adhesion ensues to continue the resistance; and, of course, when the ligature falls off, the artery opens, and the hæmorrhagy returns.

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* See the observations at the end of the next section, viz. *the ligature of arteries continued.*

OF BURSTING OF THE ARTERY FROM ULCERATION OF ITS COATS.

Yet it is not to this unhealthy condition of an artery that I ascribe the death of those who have perished from secondary hæmorrhagy. The indisposition of the arteries never can explain the difference of danger in the two operations of aneurism and amputation. In amputation of the thigh we tie the great femoral artery; we tie also the profunda, and its muscular branches; we perform amputation daily, and we tie many great arteries in each amputation; each ligature is seen moved and raised up from the face of the stump at every pulse of the artery; the stump remains open. These arteries continue for weeks to bear the whole force of the circulation, unsupported, yet they never give way.

But, in the operation for aneurism of the thigh, the difference of security is very great; for this operation is, on the other hand, so full of uncertainty and danger, that hardly any case can be mentioned in which the surgeons have not been alarmed, and the patient in great danger, from secondary hæmorrhagies: it is an operation never performed but by surgeons of the first eminence; and yet more, perhaps, have died than have survived it. Hunter himself has lost his patients; those whom he did save were endangered by secondary hæmorrhagies: and concerning the celebrated Mr. Pott, (who, from the ill success of one operation, was forced to amputate the thigh), it has been insinuated that he missed the artery altogether: "The depth of the incision made it impossible for any but the operator himself, and those who were immediately assisting him, to see what was included in the ligature, *and at the time* the popliteal artery was *supposed* to be secured by it." From this foul accusation I shall find an opportunity of defending the memory of Mr. Pott. I mean only to explain to you at present, that even the greatest surgeons have not been free from reproach; and, indeed, the imputation is fairly established, not against particular surgeons, but against the science itself,—"That the rules of surgery in respect to aneurisms are imperfect." It behoves us then to inquire, What the difference is betwixt tying the femoral artery in aneurism, an operation so full of difficulty and danger, and tying the same artery in amputation, an operation which is so perfectly safe, that the death of a patient by hæmorrhagy would be a flagrant disgrace?

Secondary hæmorrhagy arises from ulceration of the artery more frequently than from any other cause. In amputation, such ulceration happens only when the ligatures, having been firmly tied round the nerves, are prevented from slipping off, or when the whole surface of the stump falls into disease, and is eroded; but in aneurism it is peculiarly frequent, from the manner in which a great length of the artery is insulated and detached from the surrounding parts. Surgeons have been used to sew bowels, as if they had no comprehension of succeeding otherwise than by the mere firmness of the suture,—as if nature had nothing to do in the cure. In like manner, in tying arteries, they pull their ligatures with a firmness that defeats its purpose, here also they seem to depend entirely upon the mere mechanical force, as if there were no process of nature to follow this mechanical stricture, nor to support the artery when the ligature is withdrawn.

If the surgeon, forgetting how slight a force suffices for suppressing the pulse of a naked artery, and for laying its sides in contact, pulls his ligature with all the firmness which the artery can bear, although the artery be not immediately cut across, its coats may be twisted and weakened; or, though not even weakened, they may be so violently compressed that not only the portion of the tube intercepted between the two ligatures, but the part immediately under each ligature will fall directly into gangrene in place of adhering, so that, on the third day, when the ligature is withdrawn, it may bring along with it the end of the artery.

If the surgeon, in place of dissecting the artery fairly, strikes his needle coarsely under it, and includes much of the muscular substance, or other soft parts, the pressure never is sufficient, it is even at the first insufficient from the softness and yielding of the parts, there is little pressure, there is no adhesion of the artery under the ligatures, there is no amputation of the intercepted part of it; the cellular substance and muscular flesh fade and give way on the third or fourth day. But the artery itself is still entire; and the blood, by this slackening of the ligatures, passes along the canal of the artery, and out at the wounded point; and as the structure of the artery is but little affected by so slack a ligature, the artery continues entire, the ligature keeps its place round the artery, and, though it does not compress the artery, it irritates it, and is perhaps not disengaged till the artery falls into ulceration and bursts*.

If the surgeon be still more awkward in his operations, he will not merely strike his needle through the flesh, but will take the nerve into the loop of his ligature; for every great artery has the great nerve of the limb accompanying it; the brachial artery has the great radial nerve, the crural artery has the great anterior crural nerve near it, the femoral artery has the nervus longus near it; in short, the great artery, nerve, and internal veins of each limb, lie in a peculiar sheath, and, in order to tie the artery apart from the vein and nerve, it is necessary not only to cut up the general fascia of the arm or thigh, but to dissect this peculiar sheath of cellular substance. Now, authors have always talked slightly of tying the nerve, as if the tying it related only to the nerve itself! No! it relates to the security of the artery! An artery, tied with a ligature, is destroyed in a few days, but a nerve tied with a ligature is hardly affected by it. The nerves are peculiarly strong, their coats hard and firm; a ligature tied round a nerve and artery together, as it cannot destroy the nerve, keeps its hold upon the artery, till, by the irritation of the ligature, and other obvious causes, it ulcerates and bursts; or if this can be prevented, it is only by cutting the ligature timeously away, which cannot be done without a degree of difficulty and danger.

But there are still other causes of the ulceration of arteries. If the surgeon, anxious to ensure the obliteration of the artery, resolves to lay a considerable length of the sides of it in contact, what does he do but insulate the artery, tear it up from its bed among the cellular substance, separate it from all those vascular connexions which kept it alive; he exposes it to almost inevitable ulceration? This has been practised upon the femoral artery in a great variety of ways, all of them ingenious, but all in direct opposition to the principles of surgery. Thus we have an operation described, where the artery must have been completely separated from all those connexions by which it is nourished and supported in its natural state. The case is related by Mr. Home, who is generous enough to acknowledge that the operator had no share in drawing up the report. He begins thus:—"The particulars of the case I have taken from my own observation, and the information of gentlemen who attended the patient, and were present at the examination after death. The patient was a sailor, who came into St. Thomas's Hospital, to undergo the operation for the popliteal aneurism. The operator made a longitudinal incision on the anterior part of the thigh; and, having laid bare the artery, passed, by means of a tin instrument, a double tape, about one inch broad, behind the artery, the two pieces of tape lying one over the other; the piece of tin, which conducted the tape, was cut off, and a cork, nearly an inch long, was laid upon the artery, and confined to its situation by means of the upper tape, producing in this way a sufficient pressure upon the vessel included between the ligature and cork to stop the circulation, and consequently the pulsation of the tumor in the ham; the other portion of the tape was left loose. The intention of securing the artery in this way was to compress the sides of the vessel together, *and produce an union without ulceration!*

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* See the observations at the end of the section.

"The patient went on very well, and the ninth day the tape was removed, and every thing seemed to be going on very favourably, when the patient was attacked by a fever (which was supposed to be from another patient in the same ward), of which he died. Upon examining the state of the limb after death, it was found that ulceration had taken place through the whole extent of the artery included in the tape; and sinuses were formed both upwards and downwards, in the course of the thigh, to some distance."

Let us observe, for a moment, what must have been the condition of this artery. The blood was scooped out from around it, the cellular substance destroyed, and indeed almost gangrenous from the injection of the blood into it. The artery being thus entirely insulated, a cork of an inch long was laid along it, a tape of an inch broad was tied round it, and thus the artery was included betwixt the tape and the cork, while another doubling of the tape lay under the artery, a little higher up, to be used as a second ligature, when occasion might require. Thus some inches of the artery were insulated; the artery itself lay across the great sac of the aneurism, like a string across a bow; this operation was undertaken with notions of the cure, which never could be fulfilled; it was thought possible to compress the artery so curiously, and with such a nicely regulated pressure, "as to prevent the blood passing along the artery, but without causing ulceration," or, in other terms, without cutting the artery across! But the impossibility of succeeding thus is plain, from the radical proposition which I have just laid down, "it is impossible to intercept a piece of the arterial tube *so* betwixt two ligatures as to cut it off, without causing the two ends of the artery to adhere at the points where the ligature presses them together;" and the converse of the proposition is equally true, "that it is impossible to check the blood in an artery, to compress the tube, to lay its sides so closely together as to produce adhesion, without cutting off the intermediate piece." The impossibility of succeeding in such an intention is sufficiently proved by reasoning, but the danger of the attempt is demonstrated by the issue of this case, which is just what might have been foretold: "Ulceration had taken place through the whole extent of the artery included in the tape;" sinuses also had extended along the bed of the artery: had this patient survived the fever which attacked him, the artery must have burst out, he must have died of secondary hæmorrhagy.

It is this ulcerated state of the artery that makes it necessary to apply successive ligatures; and it is this diseased condition of the artery, this progressive ulceration, that makes those successive ligatures give way. In operations upon the femoral artery, in femoral aneurism, it is first of all insulated by the great extension of the sac in which it lies; it is in danger of being eroded by the very fœtid matter which always fills a great aneurismal sac, distended with corrupted blood and sanies; and it is sure to ulcerate from the coarse and complicated apparatus with which it is tied. It is usually laid out along a cork, or tied down along a piece of bent-leather, which was used indeed by Ruisch, in one of the first operations of the kind that ever was performed*. I find Mr. Duschamps using a small machine made of silver, consisting of a horizontal plate, which lies upon the artery; and in this plate there are two slits through which the tape passes, which surrounds the artery; from the middle of this flat plate stands up a shaft of some inches in length, over which the ends of the tape or ligature are tied. Concerning these machines, I feel that I do no more than justice when I acknowledge the ingenuity of the inventions; but to you I should do great injustice, if I did not protest against them as altogether inconsistent with the principles of surgery.

These contrivances for insulating the artery are sure to cause that ulceration which too many natural causes conspire to produce. The laying a piece of cork or bent-leather along the artery, the using such an instrument as this of Mr. Duschamps, the laying relays of ligatures above and below the place where the proper ligatures are applied, the tying a considerable length of the arterial canal with four thick coarse ligatures in place of two! the stripping a considerable extent of the artery of its cellular substance! the surrounding the artery with pellets of scraped lint, and keeping it extended across the foul and gangrenous sac, like a water-pipe across a hollow piece of ground! are, I think, the most certain means of causing ulceration. It is indeed here, as in many operations, that the more the surgeon trusts to his own curious machines and firm ligatures, and the less he trusts to nature, or, in other words, the more of this coarse mechanical ingenuity the surgeon displays, the greater will his patient's danger be.

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* Ligabanturque exiguo frusto corii crassioris munitæ ad arteriæ discissionem vitandam.—Ruisch.

But there are various causes of this erosion and ulceration of the artery, and, among others, the foul suppuration of the aneurismal sac; for the cleansing of an aneurismal sac is like the sloughing of a gun-shot wound; it is rather a gangrene and sloughing than a proper suppuration of the cavity. I know of no sore more difficult to heal than an aneurismal sac; it sometimes falls into actual gangrene; and this peculiar condition of it depends not upon the putrid tendency of the blood, but upon the force with which the blood is driven in, and as it were injected among the cellular substance. When blood, either from the bursting of smaller vessels, or from some more important aneurism, lies upon a bone, the bone is corrupted, and this caries is ascribed to the putrid tendency or dissolving power of the blood, while it proceeds merely from this blood being driven into the cellular substance which surrounds the bone; for the blood thus driven into the cellular substance either separates the periosteum from the bone, by being injected under it, or injures and deadens the periosteum, by being driven into the cellular substance of its outer layer; the periosteum is thus either directly detached, or soon detaches itself from the bone; and the bone, thus deprived of its nutritious membrane, becomes carious. Thus it happens that in the operation for aneurism, or upon opening the body after death, fragments of the bone are sometimes found detached, floating even in the blood, and then it is proclaimed that the bone has been in part dissolved by the blood, as if the blood were as peculiar in its nature as the Liquor Gastricus of a dog*.

The pathology of the aneurismal sac is nearly the same with this of a diseased bone. The blood is injected among the cellular substance, the parts are separated from each other, the blood is driven in betwixt every fibre, the parts are moreover compressed by the general tension of the tumor, and all the parts are, like the artery itself, insulated, deprived of nourishment, ready to fall into gangrene. The aneurismal sac either falls into actual gangrene and bursts, or is, at least, on the borders of gangrene before it is opened. The pressure is reciprocal, and the surface does not thus give way before the parts within the sac are ready to fall into universal ulceration, and to slough off; and when the sac bursts, or is opened, the putrefaction of the blood augments the natural fœtor and foulness of the suppuration. This is the reason of suppurations extending along the bed of the artery, for the blood is driven along in that sheath of cellular substance which surrounds it; this is the reason of the ulceration and erosion extending all along the insulated portion of the arterial canal; this is the reason of ligature after ligature giving way; and this is the reason why the artery is often more dangerously affected, more diseased and ulcerated even in recent wounds, than in natural aneurism and spontaneous dilatation of the artery! bursting of arteries, yielding of ligatures, sudden and fatal hæmorrhagies, are as frequent in recent wounds as in old aneurisms!

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* "Sir John Pringle told me," says Dr. Monro, "that he digested bones in putrid blood, but did not find that the blood had the least effect in dissolving them as a menstruum. The stream of blood, indeed, by continually washing the parts of the bones laid bare by aneurisms, prevents the oily matter separated from the bones from stagnating and acquiring the strong fœtid smell and high degree of corruption observed in other caries." These are indeed curious and important speculations. Dr. Hunter's account of the corrupting power of the blood, viz. Med. Observ. and Inquiries, is much of the same complexion.

Mr. Leslie performed the operation for femoral aneurism upon a boy, whose artery had been struck with a penknife, and whose aneurism had increased for three weeks, and then burst so as to endanger his life. This aneurism was recent, and was from a direct wound of the artery; it was in a young and healthy boy. Mr. Leslie had not only tied the artery securely, but had taken every precaution by proper compresses (and by tightening the tourniquet a very little) to moderate the force of the blood, "yet in half an hour after the operation, a fresh alarm was given, and the flux of blood appeared as great as at first." "He found, upon removing the dressings, that the first ligature had cut through the adjacent parts, which, from the operation being so long delayed, had become putrid, and unable to make sufficient resistance; by this means the pressure of the ligature upon the vessel was removed*." If this be the condition of the other parts, what must be the state of the artery itself, lying insulated in the centre of such a sac? What can this portion of the artery be good for, insulated, ulcerated, unfit in all respects to bear ligatures even in the first instance, and sure to give way under them in not many days?

It is from not foreseeing the ill consequences of it that the operator is tempted to go upon this dangerous ground; he ties the artery; he is at pains to keep it insulated; he is happy to think, that though it should give way, it will be within his reach; he knows where to find it; it bursts, and he ties it again. But in place of considering this part of the artery as of any value or likely to be useful, he would do well to consider it as dangerous; he should not, by any means, apply his ligatures close upon the breach or wound in the artery under pretence of saving inosculating branches; he should rather consider this as a portion of the artery, which, before the cure be accomplished, must be inevitably destroyed; he should tie the artery at the two extremities of the sac, as close as possible to the surrounding flesh, and should then cut it across, that it may shrink for protection among the flesh, and heal soundly along with the rest of the suppurating sac.

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* Vid. Dr. Duncan's Medical Commentary, Vol. II. p. 178.

[* Here we have the reasons for avoiding the operation upon the aneurismal tumor in the thigh truly and strongly represented. One step more, and we have the operation of Mr. Abernethy.]

THE LIGATURE OF ARTERIES CONTINUED†.

[Some years after the publication of this volume, there was a notion imported into this country as quite a new idea, and of the utmost value, that the operations we had been performing on the arteries did in fact resemble the operation of hare-lip; that the effect of the ligature was, in the first place, to cut and open the internal coat of the artery; and, in the second place, to keep these surfaces in contact.

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* Observation by Mr. C. Bell.

† Commentary by Mr. C. Bell.

Who but the most imperfectly educated man could receive this as a novel and important communication? Who is there that has tied a tube into an artery of the dead body, or has put a ligature about an artery to prevent certain parts from receiving the injection, but knows that a ligature, to be securely tied, must not be drawn so as to cut the inner coats, or that then the injection will be extravasated? Seeing the absurd length to which our practical surgeons were permitting themselves to be led by what they termed a fact, though in truth it was a bit of shabby theory, I undertook to prove that the inner coat of the artery need not be cut, to ensure the interruption of the blood and the full effect of the ligature. It was curious to see the sulky rejection of my proposal to stop the artery without compressing it at all. I wished to prove that their notions were too mechanical, and that one important effect of the presence of a ligature was entirely kept out of sight.

[I took a large, round, and soft ligature, and encircled the carotid artery of an ass: the consequence was, first, Inflammation of the coats; second, The coagulation of the blood at the part so injured and inflamed; thirdly, The throwing out of coagulable lymph, and the obliteration of the caliber of the vessel at the part surrounded with the ligature.

[I have in a former commentary proved, that where an artery is injured, there coagulation of the blood will take place. When the experiment of cutting, or hurting the coats of the artery was made, by means of a small thread drawn tightly, and then immediately taken away, I anticipated that such a degree of injury of the coats of the artery would influence the blood contained, and that the coagulation of the blood, united to the coagulable lymph secreted from the inner surface of the injured vessel, would obliterate or fill up the tube. I knew that the same effect would have followed if the coats of the artery had been checked or pinched by means of the forceps, and the wound closed. But to show that the injury committed was not of the nature supposed, I laid this coarse ligature in contact with the proper coats of the artery, without drawing it; and the effect of this *foreign* body lying in contact with the living membrane was sufficient to produce that change which operated its effect on the blood, caused its coagulation, and the rest was a natural consequence.

[In this section of my brother's work the reasoning cannot be objected to; the facts are important. We should almost suppose he had foreseen the suggestion since made of using very small ligatures of a single waxed thread. This practice was introduced by Mr. Lawrence, as I have already noticed, in tying the arteries after amputation. He extended the practice to the operation on the artery for aneurism. He tied the femoral artery with a single small silk thread, and cut off the ends. It was successful, but the advantage over the common method was not apparent, since the integuments did not unite, and the wound continued discharging for a month.

[A very different method has been practised by Mr. Crampton, of Dublin. He has invented a *presse artère*, by which he surrounds the artery with a tape one-eighth of an inch in breadth, and gently compresses it. This instrument, with the ligature, he permits to be in contact with the artery for three days, and then withdraws it. The effect is the obstruction of the artery, and the cure of the aneurism.

[Both these methods succeed, yet they seem in exact opposition to each other. In what respect do they correspond? Is it not in procuring a coagulum to form, and in irritating the coats of the artery to inflame without disturbing the relations of the artery or tearing across the vasa vasorum?

[I have operated in the following manner, and I think it makes a particularly neat and a safe operation. Take a ligature of three silk threads waxed together, pass it round the artery without disturbing its connexions; take care that it be passed round in immediate contact with the proper coats of the artery, and, of course, within that division of the sheath that is appropriate to the artery; tie a single knot twice, and in drawing the ligature let the noose sink so far into the coats of the artery as to prevent it shifting by the pulsation; cut off the ends of the threads all but one. Pass this single silk thread through a needle, and pierce the integuments from within outwards, at the distance of an inch from the edge of the incision. Join the lips of the wound with great accuracy, and secure them with short pieces of adhesive plaster. The advantage gained by this operation is, the contact of the noose of the ligature with the coats of the artery; the perfect union of the lips of the wound, which is important to the state of the interior of the wound; the security against the sudden eruption of the blood by this early adhesion; and the opportunity provided by the thread for the separation of the ligature, instead of leaving it to the precarious and tedious process of suppuration.

[I prefer the single ligature upon the artery instead of the division of the artery, which requires a double ligature, as recommended by my brother, because I would sacrifice a great deal to the one important circumstance of leaving the artery undisturbed. Besides, my brother's argument of putting the artery of the aneurismal limb into the condition of the artery on the face of the stump is delusive, the analogy is by no means correct. The reason why any rude operation is sufficient for the security of the artery on the face of the stump is, because the limb is removed, and with it the excitement to the arterial action. On the contrary, when we tie the trunk of an artery without removing the limb, the stimulus to arterial action is present; for the part supplied has an influence on the state of the vessels supplying it, and while the part is deficient in blood, there is a call upon the activity of the arteries; but when the part (viz. the limb) is removed, the excitement ceases, and the vessels are permanently retracted and shrink *.]

OF SECONDARY HÆMORRHAGY FROM THE INOSCULATING BRANCHES.

There is still another kind of secondary hæmorrhagy, which arises neither from the fading of the parts, the slipping of the ligature, the bursting of the artery, nor any other cause that has hitherto been imagined. The hæmorrhagy which I am now going to explain does not even proceed from the main trunk of the artery; but, on the contrary, the life of

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* End of the Commentary by Mr. C. Bell.

the patient is endangered by hæmorrhagy from those very inosculating arteries upon which surgeons have always depended for the safety of the limb. It happens thus :—

In every part of a limb, but especially round every joint, there are frequent inosculations of the smaller arterial branches, and they are thence named the articular or inosculating arteries. While the circulation in the main trunk of the artery is languid, these are gradually enlarging: when the aneurism is near bursting, the pressure upon all the adjacent parts is very great, and the articulating or inosculating arteries are still more enlarged; and the moment the operation of tying the main artery is performed, the whole blood of the limb passes through those arteries. These lateral arteries act with particular vigour, they inosculate very freely round the sac; sometimes branches of them are cut in the time of the operation, often they are eroded from the ulceration and gangrenous condition of the sac. This is a frequent cause of secondary hæmorrhagy, and much to be feared; the patient does not indeed expire with one gush of blood, as sometimes happens when the main artery of the thigh is ulcerated and gives way. These inosculating arteries lie deep at the bottom of the gangrenous sac; they are eroded, burst out, and fill the sac with blood; and before the surgeon can be called, or that blood cleaned out, the arteries have ceased to bleed, and are no longer to be found.

One thing more is particularly worthy of observation in regard to those arteries, that not only are they eroded when they are thus exposed in the bottom of an ulcerating sac, but in those cases where the sac is left entire (the operation being performed according to Mr. Hunter's manner in the fore part of the thigh) these inosculating arteries open upon the internal surface of the sac, they convey that blood which should nourish the limb directly into the aneurismal sac; and though the main artery be actually stopped with a ligature in the fore part of the thigh, the pulsation of the aneurismal tumor in the ham returns upon the second or third day. Some years after the death of the late celebrated Mr. Pott, the following narrative of one of his operations was published. But, however correctly the facts may be stated, I will not allow myself to recite the case to you, without strongly expressing my disapprobation of many implied reproaches, which never should have been thus publicly expressed, and, least of all, after Mr. Pott's death.

"This mode of operating was adopted by Mr. Pott in a case of popliteal aneurism in St. Bartholomew's Hospital; which operation having been the object of medical attention for some time, I shall give a brief account of it, as I was present at the time it was performed.

"Mr. Pott began the operation by an incision, about five inches in length, upon the posterior part of the thigh, through the common integuments, a little higher than the tumor, and in the direction of the thigh, between the two ham-strings; he thence dissected down to the vessels at the upper end of the incision, which being there deep seated, proved both tedious and difficult. Having come to the vessels, a double ligature was passed, and the two portions tied separately, at nearly half an inch distance. The depth of the incision made it difficult for any but the operator, and those immediately assisting him, to see what was included in the ligature, and at the time the popliteal artery was supposed to be secured by it. The wound was dressed up in the common way. The second day after the operation, a pulsation was felt in the tumor, which afterwards enlarged so much, that Mr. Pott amputated the limb.

"It is said that the aneurism appeared, upon examination of the limb, to have been in an anastomosing branch, not in the trunk of the artery*.

"The following remarks upon this operation will tend, in some measure, to illustrate the method recommended and practised by Mr. Hunter. The mode of taking up the artery in the ham must be always unfavourable to the future success of the operation, if either the artery itself should be diseased, or if the tumor, by being so contiguous to the violence done in the operation, should be affected by the consequent inflammation, which seems to have been the case in Mr. Pott's operation, as I understand two abscesses were formed close to the sides of the sac. Had the aneurism been situated in an anastomosing branch of the popliteal artery, given off below the ligature, there should have been no pulsation afterwards in the tumor; and were it in a branch going off above the ligature, the pulsation in the tumor should have continued immediately after the operation, and should have been increased by it, neither of which effects appear really to have taken place, which throws a doubt upon the situation of the aneurism, if the popliteal artery was rendered impervious by the compression of the ligature."

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* How miserably ignorant must that person be of inosculating arteries, and every thing of the kind, who can talk of an aneurism of the ham being formed by an inosculating artery!

This case is a curious and happy illustration of the piece of pathology I have just explained to you. The insinuation contained in these words, "It was difficult for any but the operator to see,"—"the popliteal artery was supposed to be secured," &c. are very unbecoming. The pulsation returning the second day is an acknowledgment that the pulsation had actually ceased! The pulsation of the tumor could not have ceased the instant of the operation, nor have continued absent for two days, unless the femoral artery had been actually tied! it could not have returned from the ligature round the artery failing, for the artery was tied in a very secure manner with two ligatures, the one half an inch above the other. Had the pulsation returned from the sudden yielding of the ligature round the artery, the effect must have been sudden! but "the second day after the operation, that pulsation was felt in the tumor, which afterwards enlarged so much that Mr. Pott amputated the limb." This implies a slow enlargement of the aneurism, such as might arise from the aneurismal sac being gradually filled by some inosculating artery. The illustrative remarks about the inosculating arteries only demonstrate how little the gentleman who wrote those cruel reflections knew about the effect of inosculating arteries. But as if Providence had designed a judgment upon him, the very same misfortune happened to himself in the following case:—

"A labouring man, who was employed about a pipe manufactory in collecting and carrying the pipes, felt, after a long walk, an indistinct heavy kind of pain extending down the calf of his right leg. This first pain very soon ceased, but it returned from time to time as he resumed his wonted employment, and became daily more frequent and violent, till he was forced to confine himself; then, for the first time, he observed a tumor in his ham; and when, in the end, he presented himself at the hospital, there was formed a popliteal aneurism of considerable size, painful, pulsating strongly, with a throbbing motion, not only perceptible to the touch, but manifest to the eye.

"The operation for popliteal aneurism was performed according to Mr. Hunter's method, with perfect success; the artery was tied in the fore part of the thigh; the aneurism in the ham was left untouched; the pulsation of it ceased the moment the ligature was drawn; the ligature came away easily on the twelfth day; the wound healed; the tumor in the ham subsided rapidly; and in three weeks he was almost well.

"But during the cure of this aneurism, it was observed that another was forming in the artery of the left ham. As soon, therefore, as his health was somewhat restored by country air, he was brought once more to the Hospital to undergo the same operation in the other leg. This second aneurism had now acquired an alarming size; the operation was performed; and the pulsation in the aneurism ceased the moment the ligature was drawn upon the artery on the fore part of the thigh; but the following morning the patient was sensible of a violent throbbing in the tumor; and though the surgeon could not feel any pulsation, the pupils felt it. On the next day, the third from the operation, this question was decided; the pulsation was manifest to the eye as well as to the hand of every one; and the force of the pulsation distinctly increasing, was the reason of calling a consultation, wherein amputation was strenuously recommended by the other surgeons of the Hospital; but the operator himself was more prudent, and wished to try, for a few days at least, the effect of compression. The wound in the fore part of the thigh looked unhealthy; at the end of the week a hæmorrhagy took place; the blood flowed profusely, yet was easily stopped; it returned no less than four times within the twenty-four hours, but not a great deal of blood was lost.

"On the morning of the tenth day, the surgeon pulled at the ligature, but without getting it away; having pulled with some force, a smart hæmorrhagy followed; the stream of blood was florid, and flowed per saltum; but it was small, and could not be from the femoral artery; it must have been a branch only. The compress was now removed from the tumor of the ham, lest the blood should be hindered from passing downwards, and was applied to the wound over the ligature to restrain the hæmorrhagy.

"The hæmorrhagy was thus suppressed; but this compression of the wound produced a very violent swelling and inflammation, threatening abscess. It was only on the sixteenth day that the ligature came away; the compress was removed; the patient was bled, and kept very low, and in two days the symptoms of inflammation subsided; and the pulsation of the aneurismal sac, which had become very strong, entirely ceased."

I will not call those cruel remarks on Mr. Pott a posthumous assassination, nor name the person who could commit the act; I say nothing severe of his own operation; I accuse him of nothing wrong. I believe sincerely that there was nothing in this operation done imprudently, nothing left undone. I am indeed informed, upon the very best authority, that his operation was dexterously and rapidly performed; but, by thus liberally acquitting him of any fault in his own operation, I leave him but the more responsible for what he has said concerning so great a surgeon as Mr. Pott; and I state both cases in proof of these pathological conclusions, "That often secondary hæmorrhagy arises from these anastomosing arteries being dilated and eroded, or wounded in the operation, the blood welling out at various points from the walls and bottom of the sac;" and "that not unfrequently, after the great artery of the limb has been fairly tied, the aneurismal sac fills again, the pulsation is renewed, and the aneurism resumes its characteristic marks, in consequence of some inosculating artery pouring its blood into the sac. From the moment of the operation for aneurism the inosculating arteries are enlarging! by the second or third day they are able to communicate their pulsation to the sac just as in performing the operation for aneurism of the arm; the pulse of the wrist is felt by the evening of the second day. But of this secondary aneurism I should be less afraid than of a secondary bleeding; for the pressure of the effused blood, the weight of the surrounding parts, the resistance even of the sac itself, these forces, which cannot, indeed, resist the whole force of the femoral artery, will certainly be able to oppose that of an inosculating branch no bigger than a crow quill.

While the sac is filling with blood, the increasing pulsation of the bag becoming stronger and stronger every moment, must be alarming! yet the resistance will increase in due proportion, the tumor will become stationary, and a slight pressure will accomplish the cure; for the inosculating artery, which is thus active in filling the aneurismal sac, is small, solitary, and unsupported; it does not lie in the direct line of the femoral artery, but is always curled; it has no direct communication with the lower arteries, and is not solicited to act; in short, it is not, like the femoral artery, a parent trunk to many lesser arteries, whose constant activity solicits a stream of blood through it. This inosculating artery is but one of many enlarged branches, by which the limb is nourished; and no sooner is it resisted by the fulness of the sac which it enters into, and by the increasing pressure of the parts, than the blood turns aside into the other channels, and ceases to force the aneurismal sac. There are, besides, accidents favourable to the cure of this secondary aneurism, inflammation, for example, as in this last operation, where the swelled state of the parts increases the resistance; and, accordingly, no sooner did the inflammatory swelling in this case subside, than it was discovered that this threatening pulsation and extension of the aneurismal sac had ceased."

[* There is much to applaud in this passage, yet there is a fundamental mistake. It is here supposed possible that an inosculating branch may open into the sac of the aneurism. This is an idea formed on the supposition that the sac is the natural coat of the vessel dilated. This is not the case; it is a new formation out of the cellular membrane, and no artery can communicate with it by direct and open mouth. The blood, as I have proved, returns into the trunk of the artery betwixt the part where the ligature is applied and the tumor; and sometimes the communication is so direct and free, that the aneurism resumes its pulsation. See this subject further considered in the Chapter on Inosculation.]

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* Commentary by Mr. C. Bell,

CONCLUSION.

Thus have I endeavoured to investigate, in a general way, the causes of secondary hæmorrhagy. I ascribe the most dangerous bleedings, both in amputation and in aneurism, to the ulceration of the great artery. Some of the causes I hope I have explained to your satisfaction, and the practical conclusion which I would deduce from this doctrine is of no small importance; it has relation, more or less direct, to every great operation; and therefore reflect, I beseech you, on those facts and principles, and judge for yourselves. It is my opinion, that a great artery never can be safe while the ligature remains about it; for till it comes away the artery cannot be said to have adhered, cannot be buried in granulations, nor supported by the surrounding flesh, cannot be out of danger of ulceration! Nor can a great artery ever be safe while it remains insulated, though surgeons seem to take a pleasure in seeing it lying fair along in the cavity of an aneurismal sac! but they should recollect, that if the artery lies more within their reach of operation it is also surer to need it; being thus insulated, stripped of its cellular substance, deprived of its nutritious vessels, the part which is included betwixt the two ligatures must gangrene; the parts under the two ligatures often, in place of adhering, will ulcerate; the ulceration, in place of stopping when the ligatures fall off, will continue; and as the artery is an insensible and firm part, entering slowly into disease, it ulcerates slowly, and bursts only on the tenth, twelfth, or fifteenth day. We have reason then to believe that the oldest practice is the best; that whenever a great artery is tied, it should be cut across betwixt the two ligatures, that it may shrink and bury itself among the surrounding flesh. We know two important facts which direct us to this bold practice:—First, That wherever we do tie an artery with two ligatures, the intermediate piece is inevitably destroyed; and it were surely more prudent to cut the part across with the knife, than to allow it to be thus slowly destroyed by ligatures, with danger of the ulceration extending along the artery thus stretched out, and held insulated. Secondly, We know that though we are never alarmed with the femoral artery bursting in amputation where the ligatures come easily away, yet in aneurism our ligatures remain too long; they seldom loosen till the twelfth or fifteenth day; and there have been few operations in which secondary hæmorrhagies do not make part of the narrative of the case*.

I think that, by cutting across the artery, tied in aneurism, we should put it nearly in the same condition with that tied upon the face of an amputated stump. In operating in any considerable aneurism, then, I would be careful to cleanse the sac thoroughly of its putrid blood; I would not merely open the general fascia of the limb, but dissect carefully that peculiar sheath which encloses the great artery, veins, and nerve; I would tie the artery clear of the nerves, which, being indestructible, hold the ligatures too long; and I would have it clear also of muscular flesh, which, while it detains the ligature, prevents it operating fully upon the artery. The bare artery I would tie with moderate firmness, with a ligature smaller than is commonly used, and as near as possible to the sound parts. I would not insulate it with pieces of leather or cork, nor lay compresses along its course, but cut it across, that it might shrink among the surrounding flesh. In tying a great artery, I would take every precaution that might ensure the effect of the ligature upon the bare artery, and enable me to draw it early away; and I would be especially careful to prevent my ligature being embarrassed with the surrounding parts, and take great care to finger and disturb the parts as little as possible, so that immediate adhesion may take place.

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* See a former commentary on this subject.

But this subject grows too important to be confined within the limits of this discourse. The principles which are here laid down have a very general relation to the surgery of arteries; and when I shall next proceed in regular order to explain to you the aneurisms of the great arterial trunks, the signs of the disease, and the uncertainties and difficulties of each operation, you will perhaps feel the importance of those principles which I have endeavoured to establish.

DISCOURSE VI.

On Wounds of the Arteries—Of the Aneurism which forms over the wounded Artery—with general Instructions and Rules of Conduct for the Operations on great Aneurisms.

SECTION I.—OF OPERATING ON GREAT ANEURISMS.

I WILL now explain to you the nature of that tumor which rises over a wounded artery, not where the artery is cut across at the bottom of a wide and open wound, for there it throws out its blood unrestrained, and either it is presently tied, or the patient bleeds to death; but where a great artery is wounded deep among the muscular flesh, where it is punctured, for instance, with a knife, bayonet, or sword, or cut by a bullet, or splinter of shot. The blood escapes with difficulty through the narrow wound, there is little outward bleeding, the artery bleeds chiefly within! and by that inward bleeding, a tumor is suddenly formed of the most dangerous nature, requiring almost as sudden an operation as if the wound were open, and the vessel quite exposed and pouring out its blood. The artery, indeed, is still open, it is pouring out its blood among the internal parts, and nothing resists it but the skin! if that slender barrier gives way, the patient dies with one gush of blood.

OF THE MANNER IN WHICH THE OUTWARD WOUND IS HEALED, AND THE ANEURISM FORMED.

When a man is wounded in any great artery, the blood flows in so full a stream, that in a moment he faints, and it is then only that the by-standers can command the blood (by gathering up any cloths that are at hand, and cramming them into the wound in a confused and ineffectual way), till at last the surgeon comes and stops it altogether. Now, the surgeon at the first sight of such a wound is himself alarmed; he fears that it is the great artery of the limb; he is unwilling to lay open the arm or thigh, and to undertake the tying up of the great artery without some farther help and advice; he throws off the loose cloths or bandages; lays a firm compress fairly upon the wound; rolls it with a steady bandage, and leaving a tourniquet about the limb, informs the friends of his fears, and of all the expected difficulties and dangers of the case, and desires that some consulting surgeons may be called. The consultation proceeds at first upon these points,—the place of the limb that is wounded; the shape of the weapon; the deepness of the wound; but the consulting surgeons do not in general unbind the wound (at least if it be a deep and pointed wound), till the skin has adhered, till the aneurismal tumor is formed, when, being enabled to undo the dressings without any danger of farther bleeding, they have all the case before them.

The tumor rises higher and higher every day; at every visit they see a change. The tumor is large, hard, circumscribed, and beats very strongly; the skin over it begins to inflame, the wound of the knife threatens to open again, the whole limb is feeble and cold; the surface of the tumor is livid, and in a few days the beating from such an artery, as the femoral artery, is most alarming, and to the patient very awful; he lays his hand upon the tumor, and feels it beating, like the heart in its strongest palpitations. He is laid with tourniquets round the limb; he perceives by these precautions, and he feels sensibly, that should the tumor burst during the night, he must lose his life with one gush of blood. Lying in this anxious condition, he is watched continually till the hour appointed for the operation arrives; and it is then only (however great the surgeon's fears about this operation), that the patient is in any degree safe.

It is not always that the surgeon has his mind so made up to the tying of these great arteries, as to perform his operation at the first visit; and yet he may as well do so! for whether he, by reasoning, convince himself that it is safe, or apprehend it to be dangerous, to tie the great artery of the limb, still the circumstances of the wound are the same, the artery itself (whether it be the great artery or a branch, whether it be only punctured or cut across), is lost to that limb; the tying of it is no sacrifice, and as to the aneurism it is uncontrollable. Aneurism never stops; the wounded artery cannot heal; the blood spreads every day wider and wider among the cellular substance, the parts are disordered, the bones corrupted, the skin at last is ready to give way, and nothing can save the patient but an operation. The surgeon has, indeed, the privilege of delaying his operation for a week or a fortnight, but not without infinite danger to the patient in the mean time, and a more difficult operation, and more extensive disease in the end.

These considerations should determine the surgeon how to act in this critical moment. When called in good time to such a wound, he should clap the point of his finger upon the wounded artery, or make his assistant hold it while he lays open the wound more freely, obtains a distinct view of the artery, and draws it out from among the cellular substance if it be cut across, or, if it be only punctured, passes his ligatures under it with the needle, the eyed silver probe, or any instrument that is most at hand; and having divided the cord, he draws one ligature up and ties it above the wound, and the other he pulls down, and ties it below the wound. Thus may he prevent the aneurism, the extravasation of blood, and the destruction of the parts.

But in nine of ten cases, the surgeon wants the courage to do this (which he thinks a hopeless operation) upon the spot. He is anxious to have the support and countenance of others of the profession; he is afraid of a wounded artery, and shrinks from one of the most natural operations in surgery; for even a man uninstructed in our profession would instinctively try to stop a bleeding artery. The case accordingly falls to be decided by slow and hesitating consultations. The surgeons debate, Whether it be the trunk of the artery that is wounded? Whether, if it be the trunk, it should be tied? Whether the inosculating arteries are sufficient for the circulation of the limb? Whether the limb should not rather be cut off? And those important questions, those general axioms of surgery, which every surgeon should have studied thoroughly, are debated upon in the moment of consulting on an actual wound! Thus it happens, that the outward wound is compressed, the outward bleeding prevented, the blood no longer escaping outwardly, but extravasated within the fascia, removes the artery from the external wound, and this wound being walled up on its internal surface with clots, is allowed to heal! then the skin and fascia adhere, the inward bleeding still goes on, and the regular aneurismal bag is formed.

Perhaps there are certain circumstances, in which it is even our duty to bring the case into this shape; for example, if there be a wound of the great arteries in the back of the hip, in the groin, in the armpit, we cannot command the blood easily; we are not sure of clapping our finger down upon the artery, at the very point where it is wounded; we are afraid lest the patient should die (even after we have come to him) with one single gush of blood; we therefore close the narrow wound, put its lips together, settle it with a very steady compress and bandage, and try to make the lips adhere, and then we have a fair aneurism, which we can look upon composedly; we can reflect upon the course of the wound, and calculate which artery is most probably wounded; for besides the main trunk there are other arteries in the armpit and the thigh, as the arteries of the scapula or the arteria profunda, which, when wounded, will form aneurisms as large, though not so dangerous as those of the axillary or femoral arteries, and to be distinguished from them chiefly by the continuance of the pulsations in the wrist or ankle.

CONCLUSION.—You have had the whole of the facts which relate to the value of inosculating arteries displayed before you*; you know that these arteries are sufficient for any purpose in all parts of the body; you know that it is not necessary that the tide of the circulation should be gradually turned into them, but that we are perfectly successful, though they have not been slowly enlarged. You are assured that these arteries are sufficient to save the limb, and can have no difficulty in attributing the gangrene, which sometimes happens in the last stage of aneurisms (or which follows operations) rather to inflammation than to want of blood. You will hold it as an established rule of surgery, that a great artery, when wounded, must be tied; and in those cases even where you cannot find the artery, when you dare not seek for it, when you have not the necessary instruments nor assistants for tying the artery, when the patient is reduced too low for you to venture upon any operation, when you dare not in the slightest degree open up the wound; even in these circumstances, though you dare not immediately attempt to secure the artery, you will take the earliest opportunity of securing it, and will prepare for performing your operation as soon as the patient has recovered from the first loss of blood.

[† But to complete this view of the subject, I must present another case, and indicate further means to be employed. What I am about to state, my collection will prove to be true. A man being wounded in the groin, with a chisel accidentally thrown, there flowed suddenly a great hæmorrhage; but he was a sensible and resolute man, and seeing that the great artery was wounded, he grasped the integuments of the groin and closed the wound and held it tight, and there he sat upon the ground until a surgeon should be brought to him. And when the surgeon had come to him and was prepared to assist him, he was still unwilling to let go his hold, for he knew the consequence would be a torrent of blood.

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* See Aneurism.

† Commentary by Mr. C. Bell.

[But the surgeon insisting to see the wound, although it does not appear that his mind was made up as to what should be done, the patient let go, and presently the crural artery gave out its blood in jets, and the man groaned and fell back fainting, and insensible. Does not the fate of such a manly fellow strike you? Have you reflected how many pulses of this great artery will determine a man's life? Now, ask what the surgeon did? He stuffed a sponge into the wound, stopped the hæmorrhagy for the time, but was not a whit advanced, while the patient was in very indifferent circumstances.

[He resolved on a bold piece of surgery,—to tie the iliac artery above the Poupart's ligament. This he accomplished. Half an hour after which the hæmorrhage returned from the wound, and the man died*.

[What he should have done was this: whilst the sponge and the finger were on the wounded artery, he should have compressed it above; and if that could not be accomplished, he should have cut for it, and grasped the external iliac betwixt his finger and thumb. Thus holding the artery with the fingers as with a tourniquet, he should have dilated and searched the wound, and he should have tied the crural artery where it was wounded, first above the wound and then below it.

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* See what is said of the inosculation under the head of aneurism.

[And the same should be done in all wounds of the great arteries, the axillary artery, or the carotid artery, for example. Practitioners are not aware of the difference of tying an artery with a saculated aneurism, and the same artery bleeding from an open wound. In the latter case it is necessary to tie the artery above and below the wound, and to do this it is necessary to make provision for securely, though temporarily, compressing the trunk nearer the heart.]

OF THE ANEURISMAL SAC.

The arterial trunks and all their greater branches in every part of the body lie under the fascia; and seem to owe no less to the support of the fascia than the muscles themselves. Over the whole body the fascia is almost equally strong; the skin and fascia, when the wound of an artery is closed with compresses, are pressed together and adhere; the blood, by this accident, is always driven hard under the fascia, and is not generally diffused under the skin; the skin merely covers the aneurismal tumor; while it is the tense fascia that gives form to the aneurism, and constitutes its sac. The fascia, thus confining the blood, limits the size of the tumor, gives it a fair and circular form, is itself tense and firm, livid also by the colour of the contained blood, and shining like the inner surface of the gizzard of a fowl. The skin and fascia may be cut distinctly from each other, as freely as we cut the skin above a diseased breast without touching the hardened gland, as we draw our knife along the surface of a hernia, without touching the sac, or as we cut the skin above the hydrocele without touching the vaginal coat.

Nor is the surface of an aneurismal bag very irregular, even upon its back part, for each muscle is involved in its own fascia, so that the fascia is also of tolerable strength within; the internal processes of the fascia, viz. those which enclose the individual muscles, thicken when compressed by the effused blood; and the condensed cellular substance, as it is driven closer by the blood, sets some bounds to the extravasation within. Thus the blood is not more diffused among the flesh than under the skin; the blood coagulates in all the extreme parts of this circle of extravasation, and by being kneaded as it were into the cellular substance, gives a peculiar firmness to the tumor.

The fascia, then, makes the great covering of every aneurism, but the strength and consistence of the sac, and the succession of parts, must vary infinitely according to the nature of the wound. If the aneurism be in the thigh, and be formed by a fracture of the thigh bone, instead of being formed only under the general fascia of the thigh, it will extend under all the muscles; and in that case the cellular substance which connects the muscles with the periosteum, and those divisions of the general fascia which connect the several muscles with each other, will form the sac. The vastus externus, vastus internus, and the rectus cruris, will lie extended over the whole sac; the general fascia of the thigh (extended in its turn over the muscles) will thicken, and form an outward capsule, as it were, including the whole tumor, muscles and all; and over that will be the skin quite moveable, and disjoined from the fascia by cellular substance, except in those parts of the surface near where the wound is, and where of course the skin is fixed by inflammation.

But if the femoral artery be wounded with a ball or knife, either cut entirely, or almost entirely across, this will be the condition of the parts. The skin and fascia will be united, the skin and fascia will form the two coats of the tumor, the blood will be widely diffused both before and behind the wounded artery, and the cellular substance which surrounds the artery being undermined by the blood, the artery itself will lie at the bottom of the aneurism wholly insulated.

If the aneurism be formed by a small puncture on the fore part only of the artery, the blood will not separate the artery from the surrounding parts; the general fascia of the thigh will form the principal part of the aneurismal sac, the blood will lie altogether on the fore part of the artery, and the artery itself will lie imbedded among the muscles, almost concealed by the inflammation and thickening of the cellular substance, none but the wounded part appearing.

When the aneurism is in the bend of the arm, the artery lies superficial, is covered only with the fascia and skin, and the fascia makes the sac of the aneurism. The fascia is at this place peculiarly thick and strong, it resists very powerfully, the aneurism is not that diffused tumor that is generally imagined, it is as fairly circumscribed as any sacculated tumor; and so elastic is the fascia, and so much are the parts straitened within, that the moment the incision is made through the skin the aneurism protrudes, the skin retires on each side, and the sac appears as fairly circumscribed as if the incision had been made over a hernia or a hydrocele.

Conclusion.—Thus the succession of parts regulates the several steps of our operation for this aneurism from wound of the artery. Our first incision penetrates the skin and cellular substance only, and unless the aneurism be on the point of bursting, this incision never touches the sac, but is carried lightly through the skin over the tumor, so that the skin retires on each side, and the tumor protrudes. Our second incision is made through the sac, the tumor protrudes, and the transparent fascia which forms the sac allows the blood to be seen through it. The tumor is of a purple colour, shining and tense; the lancet is struck into the top of this tumor, the blood begins to roll over the edges of the incision, or to be thrown out in great clots; the surgeon introduces his finger, and runs his knife upwards and downwards along the whole length of the tumor. To use a scoop for the blood is absurd; it is very like the formality of a systematic writer to commend such an instrument, but it is very unlike a practical or dexterous surgeon to use it, or even to lay it among his instruments. He turns out the clots with his fingers, and then sees the artery lying flat at the bottom of the tumor. The succession of parts is very regular, yet, since the form of the aneurism is various, since no dissection of the sound parts, no description of aneurism, can give a perfect idea of the relation of parts to each other, let the surgeon be prepared for difficulty and confusion; let him prepare himself for encountering such difficulties, by considering the duration and progress of the disease, and the manner in which the artery was wounded. Let him try to imagine how the parts will lie with regard to each other, whether the aneurism be under the fascia only, or under the muscles, whether the parts be separated from each other, or massed together by inflammation, and by the blood driven in among the cellular substance.

Thus the advantages to be derived from an aneurismal bag being formed over a wounded artery, either before we are called, or by our own compresses forcing the wound to heal, are these.—That we are not hurried, all at once and unprepared, into the midst of a bloody operation; that we are somewhat easy about our patient's immediate safety, there being no danger of immediate bleeding, at least for a few days; that we have timely warning of every danger, by the changes on the surface of the tumor, which turns livid, inflames, and gangrenes, before it bursts. The wound suppurates, opens, and discharges a thin serum, before the actual blood bursts out, whence we have time to consult, to calculate which artery is wounded, and to settle all the steps of our operation as deliberately as on any ordinary occasion.

[* But my master is here describing a circumscribed aneurism. Now, it has been explained, that a punctured wound of an artery may produce a tumor, differing in no essential circumstance from a natural aneurism; and if there be no difference, why should the operation be different? You do not cut up a natural aneurism, but tie the artery above it; so you may do here in a punctured artery, if the tumor be small and circumscribed.

Here then the surgeon must determine for himself according to the nature of the case. A wounded artery, with diffused blood, must be tied twice, that is, immediately above and below the wound, as above directed; but a wounded artery and circumscribed tumor of blood may be operated on, according to the method of Mr. Hunter, or rather on that principle.]

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* Commentary by Mr. C. Bell.

OF THE CONDITION OF THE SURFACES OF THE ANEURISMAL SAC.

But it is equally plain, that though a recent aneurism is thus managed with more ease to the surgeon, and less loss of blood to the patient, than a large and open wound; yet an old aneurism, suffered to grow for weeks or months, is attended with greater danger. For if the artery be very great, as in the hip or thigh, the bag enlarges very rapidly, all the parts are compressed and hurt, the blood is driven deeper and deeper among the muscular flesh, and at the same time that the soft parts are disordered, even the bone may be spoiled, which must render the operation ineffectual in saving the limb. The same accumulation of blood that makes it more difficult to find the artery, presses it deeper every moment, and farther out of the reach of the surgeon; the sac, in an aneurism of the thigh, becomes, in a few weeks, capable of holding six or seven pounds of blood, and this extension of surface is the cause of profuse suppuration, which (wherever the matter is, as in this case, contaminated with blood), is never kindly.

Two things conduce to throw the whole of these surfaces into a very unfavourable condition: First, The skin is so extended that its vessels are compressed, it is deprived almost entirely of circulation, and becomes livid, like a strangled part; at last it falls into actual gangrene; and such is the morbid condition of the external surface, that frequently the parts are hardly to be distinguished from each other; the skin, fascia, and coagulated blood, are all one pulpy mass. Such skin cannot recover its healthy state; and in those cases where the aneurism has been thus extended to bursting, part of it has been often cut away. Among the old surgeons, as Saviard, Severinus, and Ruisch, we find, that the operation for aneurism was so much dreaded, that it was never voluntarily performed; aneurism was often at the point of bursting before the surgeon would put his hand to it; he operated only in extremis, with no other design than to save the patient from immediate death; and this is the reason why those old surgeons very generally began their operation with a crucial incision, and finished by cutting off, with great scissors, the four flaps or corners of the skin.

While the surface of the tumor is thus passing through the various stages of suffocation and gangrene, the parts within are not in a much happier state for recovering. The pressure is mutual, the internal surfaces are compressed, while the outward surface is extending, and the blood is so driven in amongst the cellular substance that it is choked with the extravasation; the smaller vessels of the internal surface are suffocated, and the blood suppurates out from among the cellular substance very slowly, and with a very foul discharge, whence the whole inward surface of an aneurism often sloughs like a gun-shot wound. This is perhaps the cause sometimes of secondary hæmorrhagy, arising from the ulceration of the smaller arteries, and the universal bad condition of the surface. The older surgeons provided for this. They cauterized the sac of an aneurism with red hot irons, because of its being a surface which must necessarily slough; and they dressed the basin of the sore, like that formed by a cannon-ball, with hot turpentine, and powders composed of nitre, myrrh, and other antiseptic gums.

Conclusion.—Though it is not our practice (nor is it necessary even in the largest aneurisms) to make crucial incisions, to cut away the flaps, to extirpate the sac, or to cauterize the surface, by which the ancients thought to dry up the putridity, and promote the sloughing; yet this gangrenous condition of the wound is never to be overlooked; and the filling of such a sac with lint covered with powders of myrrh and bark, or of stimulating it occasionally with turpentine dressings, or a spirituous balsam, is peculiarly proper. And since we foresee this sloughing state of the sore, and are aware that the blood which remains is apt to hurt the disposition of the wound, we should perform no part of the operation more carefully than that of cleansing the sac. Instead of merely clearing away the great clots of blood, so as to see the wounded artery, we should wash and sponge it with particular care, fill it slightly with caddis or scraped lint, and compress it moderately with a general bandage.

I remember an operation in which the femoral artery was found and tied with great difficulty. The tourniquet gave way, the blood was flowing out with great impetuosity, the operator was timid; instead of expecting to stop the blood only by slitting up the tumor rapidly, he expected to check it, by closing the sac, and by pressing down the lips of the small incision which he had just made. The scene of confusion during this moment was indescribable; but he saw that the man's life was in jeopardy, and he at last resolved to slit up the tumor; he did so, and I clapped the point of my fore-finger upon the slit in the artery, which lay firmly imbedded among the muscles. There had been such manifest danger and alarming loss of blood, that the surgeon now resolved to come at his object the nearest way; he would not consent to dissect round my finger, and clear the artery of the surrounding parts; but taking a large needle, he struck it very deep under the artery, through among the muscular flesh; and the ligature was so exceedingly thick, that it required the assistant-surgeon to pull with all his force before he could compress the artery. The moment I lifted my finger, the blood came from below with almost the same force that it had flowed from above *; a second ligature, equally clumsy, was struck under the artery a little lower, and then the hæmorrhagy was perfectly suppressed, the sac was cleaned, and the patient laid in bed. This hurried operation, these coarse ligatures, and the deep stroke of the needle, though they saved the man from immediate loss of blood, actually endangered his life. The anterior crural nerve, and much muscular flesh, were enclosed in the coarse string that was used, and on the eighth or tenth day the artery ulcerated; it burst out during the night, and the patient was in great danger; the bleeding was prevented by firm compression, and thrusting down a sponge upon the artery.

CONCLUSION.—Never delay your operation, that

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* See the Commentary, p. 366—7.

the inosculations may in the progress of the disease have time to enlarge; for the most sudden operations have been the most successful. Never wait for the diffusion of the blood, that it may insulate the artery, and make it be more easily found; when such a rule is proposed in the following direct terms, I believe it will appear in all its absurdity; "Would you wait till the blood injected among the cellular substance, separated those parts which you ought to dissect?" This delay occasions an extension of the sac, and a bad condition of the sore, and endangers secondary hæmorrhagy, from erosion of the inosculating vessels.

Never be in a hurry in tying the artery; for as soon as you see the wound of it, and have got hold of the vessel, the danger is over. Do not allow yourself to strike your needle coarsely through among the surrounding parts, nor tie in the muscles nor nerve; for the muscles fade, so that the ligature relaxes, and the nerves remain unaffected by the ligature, and continue to hold it fast, till the artery, after having united happily, inflames, ulcerates, and bursts out anew.

OF THE DIFFICULTY OF COMPRESSING THE GREAT ARTERIES AT THE AXILLA OR GROIN.

In performing our operations on the great arteries of the arm-pit or groin, we must trust nothing to assistants, nothing to compression of the artery; we must do our operation with peculiar boldness and skill, otherwise we shall hardly save our patient, for in a single moment he is either safe or dead.

Camper was the first who imagined, that the axillary artery might be compressed above the place where the tourniquet can be applied. He demonstrated the fact; he put the pipe of a syringe into the right subclavian artery; he threw water along the arteries, and allowed it to flow out, by opening the left axillary artery. He then applied his thumb upon that artery, *below* the clavicle, and found, that by a moderate pressure he could resist the stroke of the syringe, and prevent the water flowing out. Mr. Blizzard was the next who spoke of this observation as of importance, especially to the military surgeon. Perhaps there could not be a more patriotic and sensible thing, than to give a lesson on the application and use of the tourniquet to the cadets of the Artillery School; and in a discourse on this subject, we find Mr. Blizzard giving a slight sketch, by Cipriani, of the manner of applying the compress, and of fixing it by pressing with the thumb *above* the clavicle. The expectation excited by so natural a proposal, so well supported by anatomy and by experiment, if not by experience, was very great. It was very natural to suppose, that it must be equally easy to compress the femoral artery at the groin; at last it came to be universally believed, that the surgeon had no reason to be afraid; that if he failed to suppress any hæmorrhagy it must be for want of skill; that the fixing of the thumb over the artery at the clavicle or groin, was as effectual as the application of the tourniquet itself. What good or harm may have been done by this invention, it were presumption in me to say; but this much it is my duty to mention to you, that this method of compression is insecure; that it will be apt to fail you in your greatest need; that the living circulation, and the struggling of a man under the tortures of an operation, is very different from the experiment made by Camper, with an anatomical syringe on a dead body.

I will also tell you what I have actually seen. In an aneurism of the axilla, the surgeon trusting to the compression which his assistant made above the clavicle, opened the tumor, was deluged with blood, and saved the patient only by striking a great needle under the artery! he saved his patient for the moment, but could not save his life; he died of hæmorrhagy in a few days.

A friend of mine appointed myself and another surgeon to compress the artery of the groin, while he performed the operation for femoral aneurism. Our cushion was well made; our pressure upon the artery in making the experiment beforehand stopped at once the pulse in the foot and the throbbing of the aneurism; we pressed much more firmly during the operation.. I fixed the compress with all my force; the other gentleman lay over me, and supported my thumbs with his! We had every reason to believe that we had a perfect command of the artery; yet at the very first stroke of the knife, the surgeon, having cut into the aneurism, was covered with blood, and saved his patient with difficulty.

Mr. Allanson was called to a man who had been blown out at the port-hole of a ship by his gun going off while he was ramming home the charge, and found the arm so shattered, that he was forced to amputate at the shoulder joint. In performing this operation, he found that the compression of the subclavian artery, even in a man who was lying quite stupid from the violence of the explosion, had not the slightest effect upon the artery; for having begun his incision on the part the most distant from the axilla, on the outside of the arm, he found the smallest branches bleeding profusely; and his expression is remarkable—"after which an arterial branch discharged so freely, that we were convinced the pressure on the subclavian artery was not effectually, though judiciously made *."

CONCLUSION.—I will repeat with confidence what I have formerly affirmed, "That it is one thing to suppress the pulse in the lower part of the limb, and another thing to stop the pulse in the great artery."—"I have tried in great operations near the trunk of the body to stop the blood by pressure; but though I could suppress the pulse of the femoral artery with my fore-finger, I could not command its blood with the whole strength of my body."

[† It is strange that my brother came here so near the truth, and yet permitted it to escape him. And those who followed him, when they thought they were very sore upon him, were propagating the same error. Thus we know that a celebrated surgeon, in a public hospital, gave this reproof to a pupil who still held out for the opinion of Mr. John Bell, "that it was dangerous to trust to compression." This surgeon was amputating without the tourniquet, and having, by mere compression near the groin, stopped the bleeding from the femoral artery, he directed the stump in the face of the student, and let off a jet of blood upon him.

[The fact is, as it is strongly expressed by my brother, the blood will flow notwithstanding the utmost compression of the thumb or knuckle on the inguinal artery; and this he is quite right in assert-

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* Allanson, p. 185.

† Commentary by Mr. C. Bell.

ing, "though as many devils as there are tiles in Bath were combined against him." The truth of the matter is, that if the inguinal artery were squeezed with a vice, the vessels of the thigh would bleed notwithstanding. Of this I had a good example to the point. A little fellow, a French doctor, allowing that he was not heavy, said confidently he could compress the great artery; for which purpose he mounted over my patient. I said to myself, "My little friend, do your best, but I won't trust to you." I began the high amputation by a cut with the scalpel, which laid bare the artery. I passed a ligature around it, and tied it. Then taking the amputating knife, I placed the edge in the first incision, and cut across the artery just below the ligature and the muscles of the inside of the thigh by one sweep; of course not a drop of blood flowed down from the artery, but it flowed the other way! It flowed back in pulses from the lower orifice! I remarked it to Mr. Shaw at the moment, who was assisting me, and he caught the orifice betwixt his finger and thumb. My reader will understand what happened. If I had made my incision in the usual way, I should have fallen into the belief of the surgeon who squirted the blood in the face of all unbelievers in his doctrine and practice. But as I had not divided the collateral branches, and only the trunk itself, the reason of the discrepancy of opinion was apparent. Compress the trunk ever so securely, if you leave the circuitous circulation free, the blood will flow during any operation on the thigh; and practically considered, my brother is quite right: do not trust to compression, or you will be convinced of your improper boldness, by being deluged with blood. You may, in any operation, grasp the thigh with your hands, as surgeons did before the invention of the tourniquet, and stop the hæmorrhage from the face of the stump. Under this security, if you can trust to the strength of your assistant's grasp, you may perform any operation. But if you compress the femoral or crural artery alone, and if you allow the vessels of the perineum, and hip and thyroid hole, to be free in their connexion with the vessels of the thigh, you will have a full tide of blood, and all the consequences which you might expect from an unrestrained femoral artery. Ingenious and fertile as my brother has shown himself, he paused before he ventured to explain away a fact. I well remember Mr. Russell of Edinburgh and two others lying over a patient, and trying to compress the femoral artery without effect. The blood still flowed, and the patient was nearly lost. These were modest men, but I have seen others, over-confident, make themselves deservedly ridiculous, by their exhibitions in compressing the great arteries. The following examples were sent to me by a pupil. An eminent surgeon, wishing to show that the leg might be amputated without the application of a tourniquet, took the opportunity of doing so on a boy of ten years of age, who had been much reduced by long suffering, consequent on white swelling. The thigh was so small that he could grasp it with his left hand, and complete the amputation with his right. A considerable quantity of blood flowed from the branches of the profunda, and though little or none escaped from the femoral artery, still much more was lost than the boy in his reduced condition could spare. On the same morning, a stout young sailor was brought into the operating room. His leg had been amputated in the West Indies, but the stump had never healed, and was now in such a condition that a second amputation was necessary. As no tourniquet had been employed in the operation on the boy, the surgeon, who was to operate on the sailor, seemed to think that he ought not to apply a tourniquet when he was going to take off only a bit of the thigh. He accordingly commenced by making a deep incision through the muscles on the inside, about five inches above the face of the stump. There was immediately a gush of blood, although two assistants were pressing firmly on the groin. The patient became very restive, would not lie still, and threw his stump about, so that in a moment every person in the circle was covered with blood. The utmost scene of confusion ensued; the operator was seen grasping and embracing the stump, while additional assistants sprang upon the unfortunate patient, who at last gave a deep groan, fainted, and enabled them to finish the operation.

[The freedom with which the blood returns by the inosculating arteries of the shoulder was well illustrated by a case which occurred to Mr. Smith, surgeon of the Leeds hospital, who I am proud to say was my pupil. A girl had her arm torn off near the shoulder by machinery. There was no bleeding, nor could the trunk of the artery be seen. As the arm had been almost fairly amputated by the machine, it was unnecessary to do more than make the edges of the wound even, and bring them together. As the axillary artery had not been tied, the patient was carefully watched. In the course of a few days hæmorrhage did come on, and Mr. Smith very properly tied the artery just below the clavicle. The bleeding from the stump immediately stopped, and every thing went on well for several days; the stump became clean, and was granulating, when a second violent hæmorrhage took place from it. Mr. Smith did not reach the hospital until the patient had lost a considerable quantity of blood. He immediately tore open the stump, which was already partly united, and now he saw the blood issuing from the main artery. He secured it, but the patient sunk next day. On dissection, and by injecting the vessels, (the preparation of which is in Mr. Smith's possession), it was shown that the artery, where it had been tied below the clavicle, was obliterated, and that the blood had passed round by the supra scapular branch of the inferior thyroid, from the portion of the subclavian artery above the ligature, into the part below. The same occurrence has taken place after the operation of subclavian aneurism, and the sac has in consequence burst. But this case of aneurism is not so striking a proof of the freedom of inosculations as the case detailed; for in it we might have reasonably expected that since the call or excitement to the action of the arteries was removed by the loss of the arm, the inosculating branches would have become diminished instead of being enlarged, as they almost invariably are after the operation for aneurism.

[In some cases of amputation of the shoulder joint, which have been performed in London, or rather in the neighbourhood, the operators must admit that either their assistants have been unable to compress the subclavian artery effectually, or that the blood comes round in the manner already described; for that the blood does issue from the axillary artery, when it is cut through, and of this the clothes of all those who were near the operators have borne sensible proofs.

[I beseech you, then, do not deceive yourselves with any such expectation; do not believe that the effect of this pressure is such as to allow you to perform a quiet deliberate operation; look upon this operation as one where you have to deal with an open artery, and lay your account with being covered with blood the moment you open the sac. Nor must you ever expect to clear the great cavity of blood so as to enable you to see the bleeding artery; it will, on the contrary, fill the cavity with blood faster than you can bale it out, till the patient breathes his last. Operate in such cases with that rapidity and decision which can alone ensure your patient's safety; there are occasions in which the old seducing word Caution is full of danger.

[This deliberate and careful detail is necessary for your understanding the various difficulties of this case; but the description is not such as to carry you along with the rapidity and hurry of an actual operation, nor does it leave that impression upon your mind which should prepare you for operating *.]

THE OPERATION DESCRIBED FOR A DIFFUSED ANEURISM, FROM PUNCTURED OR TORN ARTERY.

When you are to operate on any great aneurism high in the limb, take all the advantage that compression or the tourniquet can give you; but do not trust to them; do not allow yourself to be confounded

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* End of the Commentary of Mr. C. Bell.

though the blood rush out upon you; be prepared to do your operation with an intrepidity which shall make you independent of every assistance. First draw your knife deliberately and fairly over the tumor, so as to lay it open. The skin being thus divided, the great livid bag of the aneurism, surrounded with its strong fascia, rises into view. Next push your lancet into the sac, and then do all that remains in your operation with great boldness; run your bistoury upwards and downwards so as to slit up the tumor quickly; plunge your hand suddenly down towards the bottom; turn out the great clots of blood with your hand and fingers, till having reached the bottom entirely, you begin to feel the warm jet of blood, and directed by that, clap your finger upon the wounded point of the artery! as it is but a point, your finger will cover it fairly, and your feeling the beating of the artery will assure you that all is safe.

Now the bleeding, confusion and fainting are over in a moment; the operator breathes, and the assistants are composed; and all the operation goes on easily and safely. The artery is effectually commanded by this pressure with the finger; but the first movement in such an operation, viz. the act of stopping the blood, of getting at the artery, is all boldness, and little of caution; no danger is to be apprehended, but that of suffering your patient to lose blood.

Being now composed, you take time to arrange every thing for the next step of your operation; you feel the beating of the artery with the point of your finger, perhaps you raise the point of your finger for a moment, to discover whether the pressure of your assistants, at the groin or clavicle, commands the artery: if so, you lift your finger, and examine round the artery; if not, you keep your finger steady, make the assistants clean the sac round the artery; then, if the artery lies fair and free in the bottom of the cavity, you proceed to tie it; but if not, you must dissect round the artery, until you see it free from other parts, and have it so insulated that you may put your ligature under it, unless, indeed, the recollection of some great trunk being near the wounded artery (as of the profunda, when you are tying the femoral artery), should stop you. But yet the nearness of any great artery or nerve is an argument as strong against your diving with the needle to catch the wounded artery, as against your dissecting with the knife. Since, therefore, the dissection is done with your eyes open, and you can see and feel before the point of your knife, rather dissect, or sometimes tear the artery naked with the point of your fingers, tie its open mouth, if cut across, as fairly as in an amputated stump; or if it be punctured only with the point of a knife or sword, put two ligatures round it, one above and one below the wound, and put them neatly and fairly round the artery, and then cut the artery across betwixt the two *.

With respect to the size and form of your ligatures, do not allow in yourself the slavish and absurd fear of cutting arteries across with your threads. It makes surgeons use clumsy ligatures in amputation, often ineffectual; and in aneurisms of the thigh or shoulder, such tapes are used as it would be impos-

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* I have said that the surgeons of the present day do not consider it necessary to divide the artery, though in a wounded artery (in an open wound) the ligature must be put above and below the wound of the artery.—C. B.

sible to draw tight even round the aorta, though that could become the subject of operation; the circle of the knot made by such a ligature is often wider than the diameter of the arterial trunk round which it is tied! Surgeons have complained that they could not draw their tapes tight enough round the femoral artery, even with the whole strength of their hands.

Let your ligature, then, be made of three or four threads well waxed, tied not with the surgeon's knot, but with one single knot moderately drawn, secured with a second single knot, the threads left hanging from one corner of the wound. It can hardly be necessary to advise, that after such operations upon the femoral artery, tourniquets should be still kept round the limb, to guard against those accidents which have so often happened, and will, we fear, continue to happen, in the hands of the most famous surgeons.

But if it chance that the parts are so massed with inflammation, so disordered by the driving of the blood in old aneurisms, or perhaps so hurt, as to be almost in a state of gangrene; if the surgeon cannot by any means get a fair view of the artery, and that his patient be losing blood, pouring from some great trunk, then he must strike his needle at random, in order to come at his object the nearest way; and the only satisfaction that he can have, or the only proof of his having tied the artery at all, will be the sudden stopping of the blood when he draws his ligature. In circumstances like these, the greatest surgeons (even Mr. Pott himself), have been accused of having missed the artery; the artery at all events, in such a case, is irregularly and insecurely tied; the attendants that are appointed must be skilful, and must be interested; both friends and surgeons should watch over the patient's life most faithfully, for successive bleedings will happen sometimes from so slight an accident as a sudden turn, or unwary motion in his bed during the night.

Of one thing I am chiefly afraid, namely, that my description may seem overcharged; that I may appear to have exaggerated the difficulties of an operation like this; that it may be thought that an accident requiring all these precautions, and this plunging down of the hand, can hardly occur. Therefore I submit to your consideration the following case, and I dare say, you will find that it needs no apology; but that, as it is new and interesting, it deserves its place.

"A poor man, who was by trade a leech-catcher, fell as he was stepping out of a boat, and the long and pointed scissors which are used in his business being in his pocket, pierced his hip exactly over the place of the sciatic notch, where the great iliac artery comes out from the pelvis. The artery was struck with the point of the scissors, it bled furiously, the patient fainted; and in so narrow and deep a wound, the surgeon, when he came, found little difficulty in stopping it up, and less difficulty still in making it heal. The outward wound was cured; the great tumor soon formed; and the man travelled up from the north country, where the accident had befallen him, and in six weeks after arrived in our hospital here with a prodigious tumor of the hip, his thigh rigidly contracted, the ham bended, the whole leg shrunk, cold and useless, as if it had been an aneurism rather of the artery on the fore part of the thigh.

"The tumor was of a prodigious size, and by that very circumstance of its being one of the greatest aneurisms, it had lost all the characteristics of aneurism. There was no pulsation, no retrocession of the blood when the tumor was pressed upon; there was nothing else peculiar in the tumor except this, that the great and sudden distension occasioned great pain; and from the continual pain, and lameness, and from having some hopes of a cure, he was ready to submit to any thing, beseeching us to operate.

"There was little doubt of this being a great aneurism, but there was a possibility of its being a vast abscess; and it was resolved in consultation that the patient should be carried into the operation room; that a small incision should be made; that the skin being cut, the bag itself should be just touched with the point of a lancet; if found to contain matter, it should be fully opened; but if blood, then it was to be considered as an aneurism of so particular a kind, as to entitle us to call for a full consultation.

"I made an incision two inches and a half in length; the great fascia of the hip appeared blue, and very strong, forming the coat of the tumor, and under that were seen the big fibres of the great glutæus muscle. The knife was struck into it, and large clots of very firm black blood rolled out; for such was the tenseness of the tumor, that it began to emit the clots in this way, the moment it was punctured. There was one thing further desirable, that before we put the patient to bed, we should understand the case so far as to be able to report to the consultation, whether the artery was absolutely open, and whether it was the great artery of the hip. I continued therefore (knowing that the opening I had made could be covered with the point of the thumb) to pull out a few more clots, till the warm and florid blood began to flow; I then pushed in a tent-like compress into the small wound of the tumor (viz. of the fascia), laid a broad compress over the outward wound, and put the patient to bed, with one of the pupils holding the hand upon his hip.

"This was done at one o'clock, and at four the consultation met, and the operation was performed. And in my notes, I find two steps of the operation chiefly marked:—First, That upon our opening the tumor fully with an incision of eight inches long, and turning out the great clots, the blood was thrown out with a whishing noise, and with such impetus, that the assistants were covered with it, and in a moment twenty hands were about the tumor, and the bag was filled with sponges, and cloths of all kinds, which had no better effect than the cloths which, in any accident, the friends in great confusion wrap round a wounded arm; for though the blood was no longer thrown in a full stream, nor in jets, it was seen rising through the edges of the incision; it floated by the sides of the cloths, which were pressed down by the hands of the assistants. But we knew also by a more alarming sign that the blood continued to flow, for the man, who was at first lying not flat, but supporting himself on his elbows, fell down, his arms fell lifeless and without pulse over the side of the table, his head hung down, his face was livid, he uttered two or three heavy groans, and we believed him dead.

"Secondly, Seeing, in this critical moment, that if he was to be saved, it was to be only by a sudden stroke, I ran the bistoury upwards and downwards, and at once made my incision two feet in length: I thrust my hand down to the bottom of the tumor, turned off the great sponge which was over the artery, felt the warm jet of blood, put the point of my finger upon the mouth of the artery; then I felt distinctly its pulse, and then only was I assured that the man was still alive. The assistants laid aside the edges of this prodigious sac, and sought out the several smaller sponges which had been thrust in, and the sac being deliberately cleaned, and its edges held aside, I kept the fore-finger of my left hand steady upon the artery, passed one of the largest needles round under my fore-finger, so as to surround the artery: one of my friends tied the ligature, and then upon lifting the point of my finger, it was distinctly seen, that it was the posterior iliac artery,—that the artery had been cut fairly across, and had bled with open mouth—that it was cut and tied exactly where it turns over the bone: and although the extremities were cold, the face of a leaden colour, and the man had ceased to groan, and lay as dead; though the faint pulsation could not be felt through the skin, in any part of the body; we saw the artery beating so strongly under my finger, that we were assured of our patient's safety; however, he was so low, that after laying down the sides of the sac, and putting bandages round his body to keep all firm, we were obliged to have a bed brought in, and having given him some cordials, we left him to sleep in the great operation room, attended by the pupils and by nurses. He passed his urine and fæces involuntarily for some days, and was long in recovering his voice.

"He was cured of this great wound in less than seven months, although his cure was protracted by the foul suppuration of such a sac, and by the exfoliation of the ilium and sacrum, which spoiled, not so much from their having been laid bare by the last sudden stroke of the knife, as by the aneurismal blood having pressed upon them; the exfoliations were very large, and the sacrum especially continued exfoliating to the very day on which the wound closed.

"I do not know whether this man have recovered entirely, for he left the house lame, from the contractions of the hip and ham, and walking by the help of a stick; but however, he thought himself fit to undertake his profession, and went to England with that design *."

This case will impress the directions already given upon your mind; it is singular and worthy of its place, since the aneurism was one of the largest ever known, containing not less than eight pounds of blood. It is also an instance of one of the least probable of all wounds, viz. a small sharp point touching one of the deepest arteries, and one of the largest; and wounding it at the very point, where it comes out from the trunk of the body; and where it cannot be compressed; for though my friend Dr. Farquharson tried to make some impression upon the descending aorta, by pressing down his fist into the belly, so as almost to touch the spine, still there was a deluge of blood upon cutting up the tumor, and the artery beat strongly under my finger. But if any thing can increase your interest in this case, it must be such an accident as that which I am now going to relate.

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* Dr. Farquharson, who succeeded me in the charge of the hospital, has just informed me of this man having called upon him after his return from England, walking stoutly, and in good health.

——— M'Donald, a very stout young man, by trade a shoemaker, threw himself carelessly down on the lid of a box, where a great nail sticking up, ran into his hip. For one day he concealed the accident which had happened to him, but next day the hip was greatly swelled and very painful; the wound healed, the swelling increased for some time, and was judged to be a deep seated inflammation; and when at last the fluctuation was distinctly felt near the surface, and a little below the scar made by the nail, it was supposed to be the fluctuation of matter. It was in truth the fluctuation of blood! for the surgeon punctured the most prominent and softest part of the tumor, watery blood issued, and was stopped with great difficulty, but at last it was stopped. The integuments were by this time in a very dangerous condition, inclined to slough and give way; the original wound actually burst open, and, as well as the lancet wound, discharged blood; both wounds were now secured with compresses and a firm plaster of rosin.

It was in this dangerous moment that my friend Dr. Jeffrey was called to visit this patient. The wound was precisely opposite to the glutæal artery, at the place where it issues from the pelvis. The tumor extended but a little way above the point where the nail had run into the hip, but it was of considerable breadth, and it descended along the buttocks so as to occupy the upper and back part of the thigh. From the extent of the tumor, the blood which it discharged upon being opened, and the difficulty of stemming the torrent of blood, there could be little doubt of the nail having run into the glutæal artery.

And now ensued that agitating and turbulent scene which is occasioned by the officiousness of friends. The surgeon was absurdly blamed, as if it were possible for a lancet to reach the glutæal artery through all the thickness of the glutæel muscles. This aneurism must have been of vast extent at the time of the surgeon touching it with the lancet; it distended chiefly the lower part of the hip and top of the thigh, removing the integuments, as Dr. Jeffrey very naturally observes, at least to the distance of six or eight inches from the place where the great vessels lie in the sciatic notch. These idle reflections, which no surgeon could have given any countenance to, entirely occupied the minds of the friends in this moment of dissatisfaction; Dr. Jeffrey's opinion was rejected, and other gentlemen were called into consultation. Dr. Jeffrey's opinion was at last assented to, and the relations of the patient began to repent of the harsh expressions they had used. They now consented to have the tumor laid open and the artery sought for, but while matters were preparing for this important operation, the young man having occasion to go to stool, rose from his bed during the night, the wounds burst open, and in a few moments he expired.

Dissection.—An injection-pipe was put into the iliaca communis within the pelvis, and the femoral artery was tied under Poupart's ligament. The whole basin of the aneurism was laid open by a long incision, the coagulated blood carefully removed, and tepid water thrown into the artery. The jet of water was seen to issue from a vessel that seemed to stand out with a trumpet-like mouth, from under the haunch-bone near the sciatic notch. Here then a phenomenon presents itself, which the surgeon in operating upon such an aneurism should not forget, for he might tie what only appeared to be the arterial mouth! This was not the mouth of the artery, it was a clot of very firm blood, which, coagulating among the cellular substance which surrounds the artery, projected much beyond the mouth of it, and might have deceived the surgeon.

This firm coagulum, which represented the mouth of the artery, being brushed off, it was found that the wound of the artery had in truth nothing of this appearance; the artery was not cut entirely across, as in Stewart's case, where it was wounded with scissors, but was merely punctured with the point of the nail; the artery was the great glutæal or posterior iliac, it was wounded within half an inch of the sciatic notch, and the hole was round.

"The friends (says Dr. Jeffrey) who saw the immense quantity of coagulated blood which lay betwixt this wounded artery and the skin, were satisfied of the innocence of the surgeon, a man of unquestionable skill in his profession. The medical gentlemen were satisfied, that had the real nature of the accident been discovered in time; had the relations agreed when the opinions of the medical gentlemen were reconciled; had they consented to the operation when it was proposed; had they not obliged me to lose the favourable moment in demonstrating blood-vessel preparations to them, and explaining the nature of the accident! the life of this young man might perhaps have been saved, for betwixt the verge of the sciatic notch and the wound of the artery, there was abundance of room for striking the needle under the wounded part."

[* Some degree of ridicule was attempted to be thrown upon the narration of this case of the leech-catcher, from the circumstance of the great length of the incision. About three years ago a case of this kind presented to my observation. A heavy Irish labourer fell from a height, and dreadfully hurt his right hip. A tumor formed and extended from the small ribs to half way down his thigh, embracing the whole hip; the colours of the skin were black, blue, and green. An undulation being perceptible on the most prominent swelling of the hip, the surgeon was tempted, by the great distress of the patient, to put a lancet into it. There flowed resolved blood only, and the patient continued to suffer more and more, and at length died exhausted. On dissection I found a tumor of grumous blood extending from the middle of the thigh to the ribs. I found the glutæal artery opened, and the ilium fractured at the notch. The man having fallen from a great height, either the artery was torn by the bruise, or the bone had torn it. But the circumstance I chiefly noticed at the time was, the confirmation of the correctness of my brother's description, and the great extent of the tumor formed by this small artery.]

RULES OF PRACTICE.

After these descriptions, a few rules should be sufficient, yet I will venture to repeat such points as I think may be of particular service †.

1st. In great aneurisms of the arm or thigh, when the tourniquet can be applied, do your operation deliberately, steadily, slowly, but do not needlessly prolong your patient's suffering. Cut the skin nicely, open the sac freely, dissect the artery very clean, if it be massed along with the other parts by adhesion; and tie it clear of the nerve, and pass your ligature with a blunt needle or crooked probe; for whenever you are reduced to the necessity of using the sharp needles, your patient is in danger. Tie the artery with moderate firmness, tie it in two places (for on several occasions the retrograde blood has flowed out even in the time of the operation), clean the sac, look now attentively to your two ligatures, and if you see the upper one moving according to the pulsation of the artery, all is right. Finally, if you approve of my reasoning, cut the artery across in the middle betwixt the ligatures.

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* Commentary by Mr. C. Bell.

† Let the reader observe that the author speaks of aneurism from wounded arteries, and not of the true aneurism.

2d. When the tourniquet cannot be applied, trust nothing to the compression at the axilla or groin, for though it is sometimes effectual it often fails, and lives have been endangered by a surgeon's entering on such operations without being prepared for the worst. You find by making the experiment on your own arm that you can stop the pulse; you think yourself able to secure the patient, but it is, I protest, a mere deception, for the circulation is not suppressed when the pulse ceases, or the pulsation of the tumor prevented *.

3d. While I counsel you to trust nothing to compression, I still advise you to take every assistance; let your assistant try to compress the artery, but do not lay your account with performing a cool deliberate operation, expect rather a dash of blood at the

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* See the preceding Commentary.

first stroke you make into the sac, and confusion and alarm of every kind. Compose your mind for such a scene, bend up each corporal agent, to this attempt; expect safety for your patient from nothing but your own daring operation; be resolute, bold, and rapid, but let this boldness be the result of serious deliberation, and earnest consultation with your friends. And in what does this rapidity consist? Is it a dangerous stroke that you are to make? No surely! the rapid movement is merely slitting up suddenly the half putrid and tendinous sac, and turning out the clots of blood with your fingers, while the artery, nerve, and all the important parts lie safe at the bottom of the tumor. You are to trust much to your acquaintance with the parts, therefore make sure of your knowledge of the artery that is actually wounded; return to your books, drawings, and preparations; hold consultations with your friends; lose no opportunity of making up your mind beforehand; the more you reason upon the case, and revolve the possible dangers, the greater will be your prospect of sustaining yourself with becoming resolution in the moment of operation.

4th. Do not piddle at this operation as if it were some ordinary business, nor look timorously into the sac, soaking up with cloths and sponges that blood which you should not allow to flow; hiding the danger in this way, is but increasing it. Meet the danger like a bold and well instructed surgeon, do not be afraid to see the mouth of a wounded femoral artery, look your enemy in the face! cut the skin as slowly as you will, but slit up the sac rapidly, spread it wide, look down to the bottom, be directed by feeling the warm blood upon your finger, or by seeing the jet of florid blood! for the moment you see the artery all danger is over *.

5th. When in great wounds, as of the axilla or groin, or when in bursting aneurisms, the hæmorrhagy has been profuse, and the patient is faint and low, and almost dead, do not hasten, as a vulgar person would do, with heat or cordials, to revive your patient from that fainting which has saved many lives! Never rouse the circulation till you are sure you can command the artery.

If I have been guilty of some repetitions I hope they are useful repetitions. They are designed not for your amusement but for your instruction. As a teacher I venture to give you one admonition, which I am sure you will take in good part; think of the momentous operation which I am describing, and let that be my apology for pressing upon you this piece of advice. Do not neglect the study of anatomy; but make yourself perfect in it before you enter upon any important part of your profession, and especially before you meddle with aneurisms, where the patient's life is in such manifest danger! before you enter into the military service, where much the greater number of those who perish in the field die from wounds of the great arteries! before you begin to perform great operations in surgery, where hæmorrhagy is the chief cause of confusion, and the unnecessary wounding of arteries the greatest error. Our old surgeon, Turner, after very awkwardly comparing the searching for an artery

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* The first word in this paragraph requires an apology; it is a mean and homely expression; I might indeed save myself from trivial criticism, but I should do my reader an injustice were I to substitute for it the best sounding word in our language.

and tying it, with the seeking out a piece of cord from a bundle and tying it with two smaller threads, concludes his discourse in the following terms: "Excuse me, Gentlemen, you know doubtless what I mean by this rude simile, that the UNDERTAKER OUGHT TO BE A DEXTEROUS KNIVES-MAN OR ANATOMIST, both Myotomist and Angiotomist, not only expert in muscular dissection, but in the situation or course of the great blood-vessels also, the study and practice whereof I so earnestly pressed upon you in my last section, so that I shall shut this perhaps over-lengthened one with the same advice."

DISCOURSE VII.

OF THE OBLIQUE WOUNDS OF ARTERIES.

PERHAPS I might not be justified in saying, that the wounds of the arteries are more important in proportion as the artery is small. But of this I am well assured, that where you are not forced to operate by the great size and manifest danger of the aneurism, there is much steadiness and good sense required in resolving upon an operation, which to an ignorant man seems almost unnecessary! And there is more merit in dissecting and tying a small artery which lies buried under muscles, cellular substance, and coagulated blood, than in tying the femoral artery.

When an artery like that of the hip or thigh is wounded, it forms an incontrollable aneurism. Such an artery drives every thing before it, forms a large sac, distends more and more till it is in danger of bursting, and if allowed to burst proves fatal.

But when smaller arteries, like those of the fore arm or leg, are wounded under the bellies of the muscles, the aneurism is more irregular, the operation very difficult, and the dangers quite of another kind. The blood is injected slowly among the cellular substance and under the muscles; no sac is formed; the blood is not collected but diffused; the pulsation is slight or there is none; the limb is swelled and hard, the skin black as in a mortification, the blood bursts out from time to time. It is considered only as a hæmorrhagy, while it is in truth a diffused aneurism; the patient, by repeated loss of blood, is reduced to extreme weakness, and the limb gorged with blood, and with its parts so insulated and disjoined from each other, by the extravasation, often falls into gangrene. These are the usual consequences of such a wound! if the patient escape it is after long continued suppurations, foul sinuses, and a great destruction of the limb.

There are also certain parts of the body where the smallest arteries produce the same consequences. The axilla, for example, is a very large cavity filled with the loosest cellular substance, fit for lodging the vessels and glands. The external thoracic or pectoral artery, which if it lay along the wrist or the temple, and were wounded there, could not do the smallest harm, is capable of forcing the cellular substance of the axilla; it has as much effect on the loose cellular substance of the axilla, as the femoral artery has on the firm cellular substance of the thigh; it has often filled the axilla completely with blood, forming a very large and dangerous aneurism.

These subjects I propose now to explain to you, and shall add a few rules for suppressing the bleeding from open wounds where the arteries lie quite exposed. The radial, ulnar, and tibial arteries, in the lower parts of the limbs lie so superficial, that their bleedings ought to be easily suppressed; awkward and imperfect operations are disastrous only from the successive hæmorrhages, and not from the important size of these arteries.

The point of practice which I have first of all to represent to you, is the difficulty of finding an artery when it is wounded obliquely by the slanting stab of a knife or sword, or by the oblique course of a ball. This difficulty is greater than it will be easy for you to imagine; I shall speak the more fully upon this subject, in order to explain to you the nature of these difficulties, and to convince you of the natural dangers of such a case; but I wish to impress strongly upon your minds the still greater dangers of ignorance, or timidity; the folly of making incisions too small for the occasion, which, notwithstanding, are such as to produce all the pain of the greatest incision, without accomplishing the purpose for which they were designed.

What case is more dangerous, or what operation more important, than this which we perform upon a wounded artery? and where is the other great operation, in which our first incisions are done in this timorous way? I should, I am sure, think myself much better entitled to cut up the axilla, to get at a wounded artery, than to cut through the perineum and bladder, to extract a stone. The one indeed is the more terrible disease, but the other, as you will see by the following example, is a business of immediate life and death.

Before I enter upon the description of a case which I mean to state to you, I feel the necessity of explaining what I think is the import of the case; and, in a few words, the matter is this:—Sometimes, an artery being struck with the point of a knife or sword, is merely punctured, and not cut across. The obliquity of such a wound acts like a valve upon the artery, there is but little blood poured out under the skin, and no remarkable tumour is formed: Now the surgeon, satisfied from the sudden and violent gush of blood, that an artery is opened, feels himself called upon to look for the bleeding vessel, and to lay open the arm or thigh; but presuming too far upon his own knowledge of the arteries, he makes a new incision along the course of the artery, *neglecting the more easy and obvious way of seeking for the wound in the artery, by enlarging the natural wound.* When, for example, the artery being wounded from the outside, he ventures to seek for it by a new incision from within! He gets to that side of the artery, where no wound is; his attempts to make it bleed, only press the slit-like wound of the artery so much the more firmly down against the flesh below! He cannot see the wound, nor even believe that there is one; he tries to make it bleed, but he fails; still, he sees the main trunk of the artery lying in the bottom of the wound, beating strongly under his finger, apparently entire, and he cannot yet believe that there is any wound in it. He continues his work, but can by no contrivance force the artery to bleed; he can never see where the wound in the great trunk is, nor be satisfied whether or not the blood flows from some smaller artery; but no sooner does he leave his patient than it bursts out furiously, and bleeds from time to time, till the patient expires. If I can produce one such case, it will be at once a lesson and warning to you; and the warning will be the more impressive, in proportion to the respectable rank of the surgeon, who may have been guilty of such a mistake.

A young man of twenty-five years of age, in parrying a blow, aimed with a sharp pointed knife, at his breast, received it in the middle of his arm. The knife entered at the outer edge of the biceps, and touched the Brachial Artery; he staggered forwards a few paces, and then, fainting with the loss of blood, fell down. Unfortunately there was no one present but a young pupil in surgery, so ignorant that he bled him in the other arm, and tied up the wounded one, merely laying a compress upon the wound.

Till the eighth day, there was no farther alarm, when a very slight cough brought on a violent bleeding, then fortunately, a surgeon was called, who really understood the dangerous nature of the case, and he, in his turn, called Mr. Deschamps, upon whom the care of the patient devolved; he found the arm enormously swelled, from the armpit to the elbow, and covered with ecchymosis down to the wrist.

"At nine in the morning," says Mr. Deschamps, "I began the operation, the patient being seated, and every thing prepared. But behold, when I introduced my probe into the wound, it passed so far upwards towards the axilla, that I feared the wound was very high, perhaps in the Axillary Artery itself; so that instead of the operation for aneurism, I might find myself obliged to amputate at the shoulder joint. I begged to have another surgeon joined in consultation, and accordingly Mr. Sabbatier met me in the evening at five o'clock. The operation was performed in the following manner:"

Mr. Deschamps made an incision, not by enlarging the natural wound, but by a new cut along the inside of the arm, in the tract of the humeral artery, full six inches long, extending downwards from the tendon of the pectoral muscle along the arm; and by this incision, he penetrated into the aneurismal bag, and cleansed it thoroughly of coagulated blood. Mr. Deschamps and his assistants then suspending the compression under the clavicle, hoped to see the wound, or at least to be directed to it by the bleeding; but though they examined and wrought a full quarter of an hour, and although they saw and felt the main trunk of the artery beating under their fingers, they could not by any endeavours make it discharge one drop of blood; so that one of them ventured to say, he thought it could not be the main artery that was wounded; while others agreed, that nothing but a wound of the main artery could account for the first loss of blood.

In this state of uncertainty, it was resolved to lay an occasional ligature under the artery, which at any time might be used, if necessary, while the artery itself should be subdued by compression alone with agaric and dry lint *. Mr. Deschamps, first, enlarged

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* He is confused to the last degree in his account of the case, so that one cannot guess, whether he did or did not strike this occasional ligature through the skin and flesh, as the older surgeons did; as Mr. O'Halleran was accustomed to do on difficult occasions,

a little the wound of the knife, and introduced his finger into it, pushing it upwards towards the axilla; and by this dissection, he applied his occasional ligature half an inch higher than the point of his finger.

Secondly, He covered all the course of the artery, within the wound, with agaric and lint, secured by an eighteen tailed bandage; but so slightly bound that it did not suppress the pulse.

At four in the morning the blood burst out, but it stopped again of its own accord; it burst out twice the next day, and in like manner stopped again. On the third day it burst out yet again; but the hæmorrhage which came on upon the fourth morning was frightful indeed; the bed was soaked through and through with blood, which, from the foulness of the dressings, had contracted a horrible smell. At ten in the morning I reached my patient, says Mr. Deschamps, and undid the bandages. The agaric and lint were left in the incisions which I had made with the knife; the lint was drawn out of the original wound; there was now no bleeding, and the patient

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or as Mr. White did lately in Captain Mounsey's case. But what makes one suspect that he did so is this, that he makes the following contrast of the two parts of his operation: We resolved, says Mr. Deschamps, to use on the *inside* of the *wound*, a compression extending along the course of the artery; but beforehand, to put in an occasional ligature, "Dans cette incertitude, nous resolumes d'employer dans l'interieur de la plai une compression sur le trajet de l'artere, et prealablement de placer une ligature d'attente." And next, he says, "I passed this ligature half an inch above the place, to which the point of my finger reached within the wound;" by which it is plain, that he passed this ligature either through the skin, or through the wound he had made on the inside of the arm, and not through the wound made with the knife, which he had now dilated no further than to admit his finger, and he introduced his finger for no other purpose than to serve as a director. "Je pris le parti de choisir ce lieu pour celui de la ligature, que je fis cinq à six lignes au-dessus de l'endroit ou repondoit l'extremité de mon doigt."

was dressed as before; but again at mid-day the blood burst out with amazing force, and again it was stopped by the attending pupil. Mr. Deschamps now undid the dressings entirely, and cleaned the parts, hoping to see the wound of the artery, or at least the jet of blood, but not one drop flowed. "With a patient so exhausted," says Mr. Deschamps, "I durst no longer trust to compression; I now resolved to draw the occasional ligature, and the instant that it was drawn the blood was thrown out with force, proving very plainly that this ligature was below the place of the wound. I applied instantly a second ligature above the first, the blood was immediately stopped, and as immediately did the patient lose every degree of heat and of feeling in the limb." At this last operation of Mr. Deschamps, his patient had lost about three porringers of blood; half an hour after he fainted; in a few minutes he revived a little, but a storm passing over head at this critical moment with some loud peals of thunder, affected him so much, that on the third hour after the operation he expired.

"Upon opening the body," says Deschamps, "we found the brachial artery wounded from the outside and from behind; the wound was above the giving off of the profunda humeri, small, punctured, made with the point of the knife just under the border of the great pectoral muscle; the occasional ligature surrounded the artery immediately below the wound, and that ligature which had suppressed the bleeding was half an inch above."

These are all the circumstances of the case faithfully translated: But the manifold mistakes, though some of them are sufficiently obvious, are yet upon the whole so complicated one with another, and are at the same time so important, that I feel it my duty to explain them to you.

Was it not a weakness to suppose this same arteria profunda to be absolutely essential to the preserving of the limb? And yet this is an opinion which Mr. Deschamps declares in the most unequivocal terms. "Certain other means might perhaps have assisted me in securing the artery in this case; although after all," says Mr. Deschamps, "the wound of the artery being above the going off of the profunda, it was in vain to think of saving the arm; but still if such means had but secured the artery, and saved the patient's strength entire, we should have had in reserve the amputation at the shoulder as our last resource *."

Was it not a great weakness to think of succeeding by compresses, without the compression's being sufficiently firm to obliterate the artery? Mr. Deschamps applied his compress and bandages so slackly, that they never affected the pulse; but had he conceived the true notion of obliterating the artery, and bound his compresses so as to have suppressed the pulse, the artery must instantly have been forced to bleed, and he would thus have discovered at his first dressing what he discovered too late, and only when he drew the occasional ligature, I mean the place of the wound.

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* "Ce procédé m'auroit été de la plus grande utilité dans la première observation. La blessure de l'artére, à la vérité, étoit au dessus des artères profondes supérieures, et par conséquent trop haute pour espérer de conserver le bras; mais le malade alors n'étant pas epuisé, il restoit la ressource de l'amputation dans l'article."

Was it not a conceited and forward thing to trust thus to his knowledge of the artery, and try to find it out by a new incision, when he might have been conducted exactly to the wounded point by the plain direction of that wound through which the knife had touched the artery? By this wilfulness, Mr. Deschamps looked upon the artery on the wrong side; he saw it only through his own incision upon the inside of the arm, while it had been wounded by a stab which reached it through the upper and outer edge of the biceps muscle, i. e. from without. In short, when the man had been wounded from the outside of the arm, his surgeon looked for the wound from within, and the consequence was most natural, viz. that he felt the whole trunk of the artery beating strongly under his finger, yet could procure no bleeding from it, and could not see the wound. This case satisfies us of a fact, which is proved also by other accidents (as the aneurism from bleeding), that an artery wounded with a small and slit-like wound, though fairly cut, will yet preserve its pulse, and will not bleed.

But when Mr. Deschamps found that his incision was too short, and that his operation was imperfectly done, or not at all, when he found his patient bleeding thus dangerously, why did he not exert himself? Why did he allow his patient to endure five sucessive bleedings without even undoing the dressings, when he ought absolutely to have laid open the arm? Surely I may say that he should have laid it open, when he himself says, that he had almost intended to cut it off.

His incision was made from the border of the pectoral muscle down along half the arm, and into the aneurismal sac. Now, his finger had been passed into the stab which the knife had made, and had not by a great way gone down into the bottom of that wound; his ligature was placed no more than half an inch beyond the point of his finger, but still it was below the opening of the artery, as was proved during life by the repeated bleedings, and after death by dissection. Why then did he not go forward with his knife? Why, when he knew the wound to be oblique, when he suspected it to be high, when he thought it was even in the axillary artery, why did he not go forward into the axilla? Why should he have stopped at the border of the pectoral muscle? Or what is this pectoral muscle that it should be respected more than the other muscles of the body?

But, in the relation of this case, the last bold stroke, the only successful one, is the most melancholy thing of all. It explains but too well what ought to have been done at first, and how successful it would have been if it had been done in good time; for he at last cut open the arm, tied the artery fairly, and so prevented any further loss of blood.

This idle incision on the wrong side of the arm, on the side opposite to the wounded point of the artery; the long searching, without being able to see the artery, or to force out one drop of blood; the absurd thought of suppressing this bleeding by compression, while the pulse at the wrist remained entire; and the frequent bleedings and the final issue of the case; and most of all, the sudden falling down of the arm senseless and motionless the moment that the great ligature was drawn, including of course the artery, vein, and nerves, are the most decided marks of a bad operation, ill concerted and ill performed, and are lessons so important, as to make it a duty to criticise in these rude terms men even of the highest name; and therefore it is that I choose thus to do my duty, and to bear the blame.

But even in this matter of delicacy, I mean to do something more, both to impress this lesson, and to exculpate myself. I will not leave it for any one to say, "This, after all, may be but one mistake of Mr. Deschamps, counterbalanced by many bold and well concerted operations." It is not so; and I proceed to prove, that if, as I think, he was wrong, he was habitually wrong; that these things were not done merely through the hurry and confusion of such a case, but that this way of cutting for the wounded artery at the wrong side of the limb, was his customary and settled practice.

A young man, a joiner by trade, twenty-one years of age, wounded himself with a chisel in the thigh, with a wound slanting from without inwards and backwards; the wound was about two-thirds down the thigh; the blood flowed with great force, and the young man was carried to the great Hospital, la Charité, in Paris, where Mr. Deschamps was first surgeon*. "The next day," says Mr. Deschamps, "at seven in the morning, I examined the thigh, found it slightly swelled, lifted the dressings, and as soon as I lifted that piece of lint which lay immediately upon the wound, the blood jetted out in a full arch, and the place of the stab, and the quantity of blood, left no doubt as to its being a wound of the femoral artery, nor any question about the proper operation, which, therefore, was deferred no longer than till eleven o'clock.

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* "Au tiers inférieur antérieur de la cuisse droite, avec un ciseau dit bedane, dont le tranchant étoit de dix lignes. Cet instrument pénétra de devant en arrière, et de dehors en dedans, et ouvrit l'artère femorale."

"In presence of Mr. Chopart, Boyer, and others, I then began the operation, by passing a probe into the wound, and the direction of the wound, which it was not easy to pursue, carried the probe towards the femoral artery, and, as nearly as I could guess, towards that point where the artery passes through the triceps muscle.

"Without minding this wound at all, I made a new one, of five inches long, in the tract of the femoral artery, so directed as that the wound of the artery itself should most probably lie in the middle of this long cut. The integuments being thus opened, I dissected through that muscle which immediately covered the artery, with all possible care, till I distinctly felt the artery beating under my finger. As there was no extravasation of blood, and of course no cavity, it was impossible to lay the artery quite bare; but yet I cut it up, as closely as common prudence would allow of; the artery wounded from behind, presented no wound to me on this side; and though we suspended the compression at the groin, not one drop of blood flowed, neither from my incision, nor from the wound. Once more, I introduced the probe into the wound of the chisel, and felt the end of the probe not naked indeed, but near the course of my incision. With the point of my finger I cleaned the parts, wrought with sponges, left the artery of the groin quite free;

but still not one drop of blood issued from either wound*."

Thus was Mr. Deschamps left in great confusion: certain, by the direction of the wound, and by the bleeding, that the chisel had touched the femoral artery; uncertain only where to apply his ligatures, or how. He was, moreover, perplexed with the doubts of his assistants, who not having seen the bleeding, and seeing and feeling now the strong beating of the artery, feeling also the entireness of the pulse in the lower part of the limb, could not believe that the wound had touched the main trunk. They were also the more inclined to doubt this, from their not understanding what the blunder was which Mr. Deschamps had committed (viz. cutting on the wrong side of the artery), which made it difficult for the artery to bleed, and impossible for them to see it bleed, whether it was wounded or not.

Something they saw must be done. Mr. Deschamps, therefore, cut and dissected nearer and nearer to the artery, and came as close to it as he safely could.

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* "En presence de MM. Chopart, Boyer, et autres, je procedai à l'operation de la maniere suivante. J'introduissis une sonde dans la plaie; sa direction, que j'eus de la peine à suivre, la conduisit vers l'artere femorale, a-peu-pres a l'endroit ou elle passe a travers le tendon du grand adducteur. Sans avoir égard a cette plaie, je sis une incision de la longueur de six a sept travers de doigts sur le trajet de la femorale, de maniere que le lien ou la blessure de l'artere pouvoit etre supposée, se trouva dans le milieu de l'incision; les tegumens ouverts, je penetrai a travers le muscle qui couvre l'artere avec toutes les precautions necessaires jusqu'a ce que son battement me fut sensible.

"Comme il n'y avoit aucun epanchement sanguin, et par consequent aucune cavite, il me fut impossible de mettre l'artere parfaitement a decouvert. J'en approchai le plus pres possible, et autant que la prudence put me le permettre. Celle-ci, blesse a sa partie posterieure, ne me presentoit aucune ouverture."

The probe put into the wound of the chisel, seemed to touch the artery at the very point where it passes through the triceps muscle; he therefore struck one ligature below the artery, half an inch under the point of the probe, and of course half an inch under the passage through the triceps. By straitening this lower ligature in a temporary way, the blood was stopped in the canal of the artery, and the artery was forced to bleed above; by this mark, the upper ligature was next put round the artery, higher than its wounded point, and the loop of this ligature being also tightened for a moment, by pushing the point of the finger under it, immediately suppressed that bleeding, which the tightening of the lower ligature had produced. Every thing being thus settled to the satisfaction of Mr. Deschamps, the ligatures were drawn close and tied, the bleeding was suppressed, the wounds were dressed lightly, and every thing went on well for seven days; the limb had recovered from the loss of its main artery, and what is always more doubtful, the artery itself continued secure. But on the seventh day, those secondary bleedings came on by which so many patients have died; and it was after encountering great difficulties, after many burstings of the artery, after much loss of blood, and, of course, an irreparable injury to his constitution, that this young man was saved. In short, they saved with great difficulty a young man of a laborious profession, in the very prime of life; the arteries young, and in that flexible condition in which we should have the best hopes of procuring a speedy adhesion, of making an uninterrupted cure! This is a case which presents the following question strongly to us, "Why should not the artery have kept steady the very first tying, if it was possible to keep it steady in the end?" But as I have passed already through all those rules which direct the manner of securing any great artery, I refrain from mentioning many of the unfortunate accidents of this case, keeping plainly to the point in question.

It is sufficient to say, that Mr. Deschamps had made mistakes in the very beginning of this case, which never after could be corrected; and all the frequent yieldings of the artery, and the terrible loss of blood, were owing merely to the arteries being irregularly tied.

What business had Mr. Deschamps to trust so much to his own knowledge, as to make an incision in the course of the artery, when he might so easily have taken the plain direction of the wound? Why should he have looked on the inside of the femoral artery for the wound which had reached it from without, and which he might have known had touched the artery only on its side or back part? At the time when he might have seen his mistake, why did he continue cleaning and working on the inside of the limb, at the incision which he himself had made, when he might so easily have enlarged that wound, through which the point of the chisel had touched the artery? Surely, if the wound was not on the fore-part of the artery, where he was looking for it, it must have been behind. Why, then, did he continue dissecting, with much danger and difficulty, upon a sound part of the artery, when he might have gone to the wound of the chisel, and dissected the artery at a place where, being already wounded, it would have been less unfortunate, even should he have touched it again? But what temptation, above all, had he to forsake the course of the natural wound, since he had seen (when with his own hand he first lifted the dressings) a high arch of blood thrown directly from that wound? As Mr. Deschamps durst not make his dissection so clean, as absolutely to touch, or to surround, or to insulate the artery, what had he to expect from the deep stroke of his aneurismal needle, with which he placed the ligature? Nothing, surely, but that it should suppress the bleeding only for the time, to burst out more furiously when the flesh under the ligature faded, and more dangerously, since it might burst out suddenly in the night, perhaps after the attendants were exhausted with watching, or when, by use and custom, they were grown careless and too secure.

That the slackness of the ligature was plainly owing to the fading of the parts which were included along with the artery, is proved by the following passage:—"When on the evening of the seventh day a violent hæmorrhagy came on, I lifted the dressing, and found the ligature so relaxed, that it had no longer any purchase upon the artery, having in a great measure cut through the muscular flesh*."

Had the dressings been lifted, and the ligature found thus slackened twenty-four hours after the operation, I should have thought Mr. Deschamps not far wrong in saying, "for the ligature had cut through the muscular flesh." But when on the seventh day he finds this ligature slackened, and the muscular flesh gone, he should have said rather, "the muscular flesh under the ligature having gangrened, and being consumed, I found the ligature quite loose."

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* Je levai l'appareil; à l'examen, je trouvai la ligature relachée, et telle qu'elle n'avoit plus aucune action sur l'artère, les parties musculaires, comprises dans la ligature, etant en partie *coupées*."

[* The case narrated here is indeed important, because we have all seen something like it, with the exception of the thunder storm, which is a species of machinery in the narrative quite unnecessary. I have had a similar case to deal with,—the humeral artery struck through the muscles.—

1. In all such cases, it is not sufficient to tie the artery at one point; it must be tied with a ligature above the wound and below the wound.

2. As to enlarging the original wound, it is not always possible. For example, when the point of the assassin's knife slants upon the bone, and penetrates the triceps, and reaches the humeral artery, it would be a most inconvenient way of exposing the artery to cut up the back of the arm.

3. The gunshot probe is to be used so as to ascertain exactly the direction of the knife, and the exact place of the wound in the artery. Directed by the end of the probe, an incision is to be made direct upon the artery, and this incision is to communicate with the original wound.

4. If the artery does not bleed when it is exposed, it is to be compressed below the part where it is supposed to be wounded; and the interruption of the blood through the trunk will make it escape by the hole in the side of the artery.

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* Commentary by Mr. C. Bell.

I offer these observations with some hesitation, seeing the force of my brother's language. He states the affair very correctly, and after such a narrative, and such a criticism, the reader will be prepared,—First, To enlarge the wound, and secure the artery where it is practicable, without too deep, and consequently too long a wound, (for a wound must be long in proportion to its depth). Secondly, Where the thickness of parts is too great to prosecute the operation through the substance of the arm, to take the direction of the probe, and do as I have pointed out.]

You must next observe, that the depth and obliquity of such a wound prevents the bleeding at first; and that often it is not even suspected that an artery is wounded, when suddenly, on the tenth or twelfth day, it bursts out with such violence as to endanger the patient's life. It is not in gunshot wounds alone that this happens, where the artery is not actually open till the slough falls off on the eighth or tenth day, but in clean wounds with a pike or bayonet! for in those only, could the delay of hæmorrhagy be attributed to the obliquity of the wound. In the practice of the older surgeons, we have many examples of this, for in their days duels were frequent, and were always fought with the sword, and when a gentleman was wounded in the sword-arm, it often happened, that although the sword had run obliquely along from the wrist to the elbow, and wounded the brachial artery at the bend of the arm, no bleeding appeared outwardly, the first issue of blood was so resisted by the cellular substance, that it soon coagulated, and filled up the narrow wound, assisted by the inflammation and swelling of the parts. A firm coagulum was formed, and it was only on the tenth or twelfth day when the suppuration was free, and the clot began to separate, that the blood burst out. Le Dran's Forty-eighth Observation contains the case of a gentleman in the regiment of Noailles, who was thus wounded with a rapier in the sword-arm; the slight bleeding was stopped with small dossils of lint, and the next day his hand and fore-arm were in good condition. Le Dran, in examining them, found no symptoms of a wounded artery, there was a little ecchymosis towards the elbow, and a moderate swelling of the whole arm. The dossils were at last withdrawn, the cure went on well, the pus was formed, the arm was not swelled, no symptoms of a wounded artery appeared till on the seventh day in the afternoon! Being pressed to go backward, he went behind his tent with his arm in a sling, and having in adjusting his clothes, either streightened or twisted his arm, a considerable hæmorrhagy appeared suddenly. When the consultation met next day, it was plainly seen that the artery was open, the bloody tumor now extended from the elbow to the arm-pit; Mr. Le Dran advised the opening of the tumor, or the amputation of the arm; his advice was neglected; the army made a movement; this gentleman was sent to Namur; the hæmorrhagies returned; the surgeon was long in resolving on amputating the arm, and when he did at last perform it, the gentleman was so far exhausted by successive hæmorrhagies, that he died.

This artery was found, upon dissection, to be wounded above the condyle, and a hard clot of blood which pressed it down against the bone prevented the bleeding*.

Thus, it often happens through mismanagement, that the swelling, the hæmorrhagies, the gangrene, suddenly terminate in death; but in such wounds, the case is often protracted to a greater length, displaying, as it were in detail, all the dangers of an oblique wound.

A ball, we shall suppose, passes along the fore-arm, rakes along the two bones, wounds the radial or ulnar artery in the bottom of a deep and narrow wound, and then passes out beyond the elbow, making an opening too small to let out the blood; or we shall suppose the oblique stab of a knife, sword, or bayonet, touches an artery, lying thus in the heart of the fore-arm, under all the muscles, and close upon the bone; then the following consequences ensue. The profuse bleeding, at first, proves that some artery is wounded; the direction of the wound ascertains that it is the radial or ulnar artery; the stopping of the outward bleeding causes an internal aneurism, different from the greater aneurisms of the arm or thigh, as it lies not under a fascia, forming a fair circumscribed aneurismal bag, but under the bellies of all the muscles, which are separated from the bones by a very irregular and a very dangerous collection of blood. The outward bleeding is soon stopped by compresses, and a bandage; the friends are less alarmed, seeing nothing but a narrow slanting wound; but when the next morning they see the arm black with the injected blood, and swelled to an enormous degree, their fear is like their indifference, before quite ignorant, and beyond the true measure; they believe this to be an absolute gangrene, and that the patient is lost; while the surgeon sees in this blackness, not the signs of gangrene, but the marks of a wounded artery, and foresees a difficult and tedious operation of seeking it out.

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* In the Fiftieth Observation of Le Dran, is a case very singular and interesting, where a young gentleman, wounded in the fore-arm in a duel, had a great swelling in the arm from the elbow to the arm-pit, hard, black, and ecchymosed. He had violent pain in the palm of his hand, there was no pulsation in the wrist, the hand was cold; by proper treatment the tumor diminished, the pulse and the natural heat began to return, and the pains were less acute, when one night the patient moving his arms awkwardly in bed, felt something extraordinary, which disquieted him the whole night, and the next morning his surgeon found the swelling returned, &c. This case illustrates several of the principles which I have explained in treating on aneurism, it is a case of wounded artery obliterated by the pressure of the aneurismal tumor which rose over it; the blood was gradually discussed by suppuration, the pulse of the wrist was gradually restored in consequence of the enlargement of the collateral arteries, it is a proof that the internal hæmorrhagies which fill up the measure of an aneurism are successive, which is the reason of the irregular growth of aneurism, and of its enlarging in proportion to the freedom the patient uses with the limb.

But if, again, the surgeon have not the skill to perceive all the dangers of the case, the apparent gangrene is soon changed into a real one; the limb becomes cold, benumbed, and has a livid redness upon its surface; the skin without runs into a low inflammation; the blood within increasing every day in quantity, corrupts and bursts out; and thus, as I have hinted before, it is not merely by the wound of its great artery, and by losing the great trunk that nourished it, that a limb is lost; but in a case like this, it is lost by the deep driving of the blood among the flesh and bones. Either the outward bleeding is allowed, and the patient is in danger of immediate death, or the blood is confined, and the bleeding goes on within; so that every time the artery bursts out, the limb is injected anew, as it were, by the arteries, and is in imminent danger of gangrene at every new effusion of blood. The matter is bloody, fetid, corrupt; it prevents the reunion of the bones, (if any bones be broken), it makes foul suppurations, and extensive and fetid sores; and each new suppuration is succeeded by a dissolution of those clots which had for a time stopped up the artery, so that again the blood bursts out; till at length, after many months of suffering, the patient is forced to part with that limb which he has undergone so many dangers to preserve. The extensive sinuses, and foul sores, the disorder of the joints, and the total caries of the bones, make every such case incurable; there is, even from the very first moment, no other alternative for the surgeon, than either to perform immediately a bold decisive operation, or to resolve at once (not keeping the patient in this lingering and cruel condition) to cut off the limb. To the patient himself the question may be honestly proposed in these terms:—"Will you have this tedious, but necessary operation, of tying the artery, regularly performed? Or will you, to shun a present pain, linger for months in this miserable condition, consenting at last to lose the limb, when it is perhaps too late to save your constitution, or even your life!"

[* I cannot refrain from making a note on this statement. It is not the division of an artery, whether trunk or branch, which demands amputation, it is the condition of the limb; that condition which will prevent the collateral branches from doing the duty of the main trunk. If an artery be wounded, and a bone broken, and if the outward hæmorrhage be stopt, and the inward bleeding go on, this is the state of your operation. You cut through the cellular membrane, which is gorged with black blood; you dissect for an artery, among parts discoloured and disfigured by extravasation; you lay the broken extremities of the bones open into the wound, forming the worst kind of compound fracture; and you have to tie the artery above and below where it is wounded! The limb must inflame and become greatly tumified, and then the collateral arteries are suffocated; and if the limb does not gangrene, you have reasonable fear of the artery ulcerating on the ligatures.]

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* Note by Mr. C. Bell.

This is the full description of that case, which I hinted at in the beginning of this discourse, when I said, that sometimes the arteries are wounded deep among the muscles, and there the blood corrupting the muscular flesh, and even spoiling the bones, is the occasion, after long suffering, of the patient's losing often his limb, and sometimes his life. Nor is it necessary to produce all those mischiefs, that along with this wound of the artery there should be a fracture of the bone; the most simple puncture of the small sword, pike, or bayonet; the mere wound of the artery, often costs the patient his limb. But the case, though naturally dangerous, and requiring severe and bold operations, is rarely fatal, except from want of resolution and want of knowledge on the part of the surgeon.

The first surgeons cannot be in all parts of a field of battle. The wounds, in the first instance, are dressed, and conducted for some days by young men; it is only when the patients arrive at some general hospital that their wounds, or rather the consequences of their wounds, are rightly understood. The wounded arteries are generally no better secured than in the case related by Belloste in his Hospital

Surgeon :—" It is the case of one Beaulieu, of the king's battalion, who was wounded with a sword between the radius and ulna; he remained eight or nine days in his quarters, being dressed by one of the mates, who, without making any diversion, only shut up the wound with a *strong stopple*, which restrained the great flux of blood between dressings, but in time of dressing, he bled excessively. The blood which was extravasated in the member did there corrupt, and caused abscesses in several places, but at last his surgeon, seeing that his strength daily diminished, and fearing some fatal accident, sent him to the general hospital *." Belloste, in this case, made the same use of pellets of lint, dipped in vitriol, that you would make of sponges, by thrusting them down to the bottom of the wound where the artery was open.

In the fighting of duels, slanting wounds in the sword-arm were often cured by the suckers; by sucking the blood, by compressing the wound, by a gentle bandage and slinging the arm; they were, in plain terms, cured by adhesion. But when, in place of being a simple wound, the artery was punctured, the consequences were often fatal.

Bohnius, in his book de Renunciatione Vulnerum, relates a case which I cannot but consider as an instructive instance of ignorance and negligence. He was called to attend a young man of the first family in the province, who had been wounded in the forearm a little above the wrist; the wound was narrow indeed, but it reached nearly from the wrist to the bend of the arm, the weapon passed under the skin and muscles, it had raked along the bones, and twice in the course of ten days had the blood burst out furiously, and per saltum. The arm was swelled, the fore-arm extremely painful, a livid redness extended to the shoulder, and this gangrenous swelling burst in about three days after, at the bending of the arm, discharging a bloody and serous matter, with some abatement of the fever, swelling, and pain. But from the time of Bohnius being first called, there was for thirteen days no eruption, but on the thirteenth day it burst out most impetuously; two days after the blood burst out again; and eight days after this, the blood burst out again most furiously at both wounds, i. e. by the punctured wound near the wrist, and by the greater opening where the fore-arm had burst from gangrene. This young gentleman was wounded on the 3d of September, and after two months of pain and suffering, frequent bleedings, and continual alarms, he expired on the 9th of November.

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* Belloste, after relating the difficulties he had to struggle with in saving this man's life, concludes the case with this prudent reflection, as he terms it :—" This kind of wound, where arteries are opened, are of all others the most ticklish, they give a great deal of *trouble*, and but little *reputation* is gained by the cure."

Upon dissecting the arm, it was found that the sword passing along under the muscles from the wrist to the elbow, had slit up the radial artery for the length of half an inch, exactly up to that point where it comes off from the brachial artery. The lips of the slit were callous and hard.

[* I was consulted in the following circumstances. A child, having a sharp pointed knife in its hand, had wounded the nursery maid below the elbow, and close to the ulna. The ulnar artery was wounded near its origin from the brachial artery. It bled profusely, and the surgeon tied the main artery by the side of the tendon of the biceps muscle. This stopped the hæmorrhage for a time, but afterwards it returned from the wound. The ulnar artery was then tied below the wound, for it was apparent that the blood returned from below. What was next to be done if it should again bleed? Tie the radial artery—but it did not return. We see, however, the difficulties which overtake us when the primary branches are wounded near their trunks, and the surgeon will have to determine the propriety of tying the trunk, or of enlarging the wound, and tying the bleeding orifices. In this case there might have arisen a necessity for three operations instead of one. As it happened it was dexterously done and happily *.]

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* Note by Mr. C. Bell.

To return to cases of extravasation. Here are lessons of no small importance. The case proves, 1st. What destruction this kind of aneurism will produce, viz. gangrene and bursting of the arm. 2d. How long the artery will continue open, gradually bleeding the patient to death by successive eruptions of blood. 3d. That however painful your operation is, it must not be neglected, else the patient must suffer, and when at last the danger becomes apparent, although you should resolve to cut off the arm, it will be too late! to cut off an arm so gorged with extravasated blood, so swelled and inflamed from the wrist to the shoulder, would be doing it in the most unfavourable circumstances, and probably the patient would be lost.

An experienced surgeon would make an incision

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* By Mr. Alcock.

into such a wound at once! If the young surgeon shrinks from so hardy an operation as that of dilating a deep and slanting wound, it is because he is not aware of the danger.

These consequences are not limited to any part of the body; wherever an artery, of considerable size, yet not large enough to create a formidable aneurism, is wounded deep under the muscles of the limb, the consequences are the same. But if the wound be produced by a ball, and if the bones be fractured, the destruction of the limb is almost inevitable. I have extracted for your use, the following instructive case from Mr. Allanson's book on Amputation.

Harry Knowland, a seaman, was wounded in an engagement, with a ball, which entered under the patella, broke the tibia and fibula obliquely near their upper end, passed obliquely through the leg backwards, and a little downwards, and came out at the middle of the calf of the leg, followed by a great bleeding from the wounded arteries, and many splinters of bone *.

A well instructed surgeon would have made a large and bold incision, laid bare the wounded ves-

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* As one proof of the necessity of cutting boldly, observe what Gooch says, p. 341. " Among the rest of our conversation at this time, there was mentioned a case, in which one of the arteries betwixt the tibia and fibula was opened about the middle of the leg, and the bleeding was stopped from time to time by various methods, but at last it was thought adviseable to amputate the limb." Mr. Gooch proposes rather to cut out two or three inches of the fibula, and to expose the artery; and I would add, that I should rather do any kind of operation, however cruel and tedious, than cut off the leg.

Mr. Hey of Leeds tied this artery after cutting out the fibula, but this sawing of the bone is not necessary. The artery can be taken up without injuring the bone. See on this subject *Wiseman*, p. 122.

sels, that he might tie them; would have picked away all the looser splinters of bone, but would have been careful, above all, in tying the arteries, knowing that if they continued to bleed outwardly, the patient might die; if inwardly, that they must inject the leg so strongly with blood, that it might fall into gangrene, and would, at all events, run into a foul and gangrenous suppuration; that the bones also, far from reuniting, would, in a few weeks, be thoroughly and irrecoverably diseased.

A fortnight after this wound, nothing having been done, meanwhile, to save his limb, this man was carried on shore and put into the Liverpool Infirmary, where he lay four entire months. At first his knee and the whole leg were greatly swelled; the leg and foot cold and œdematous, with a very languid circulation through the whole limb: he had moreover a fever upon him, with a great depression and languor, a foul tongue, and a small quick pulse.

When the bullet holes were first dilated, there issued a great quantity of sanies highly fetid, mixed with clots and putrid blood; and bark and wine were used during this putrid or gangrenous state; and free dilatations were made when the time arrived, for giving vent to the foul suppurations.

In the course of this tedious case, the callus often began to form, and the surgeons entertained hopes of accomplishing a cure; but the deep seated hæmorrhagy continually returned upon him, coagulated blood was accumulated anew in every part of the limb, with a new discharge of putrid sanies, new sinuses, new suppurations; and thus, from time to time, the incipient callus was destroyed.

Four months they struggled against these disappointments and difficulties, supporting him all along with diet and wine, often dilating the openings for the putrid sanies, and sometimes extracting the splinters of bone, till at last such a bleeding came on, as put an end at once to all hopes of a cure. The whole limb was relaxed and swelled; the cellular substance gorged with coagulated or putrid blood; the hæmorrhage came deep from among the callus, from the very centre of the limb; the man was quite emaciated; his stomach was so enfeebled, that he could receive no solid food; his health was already broken, and it appeared imprudent to struggle longer, it was plainly impossible to save the limb; it was accordingly cut off*.

The plain rule resulting from this case needs hardly be explained; it is scarcely more than a recapitulation of that rule which has been already delivered: but it puts it in a stronger point of view, viz. that we should cut boldly; seek freely for the artery; tie it securely with the needle: and it is only where the artery can by no means be taken up with the needle, that you are at all to trust to the sponge, and even then, not willingly, nor without every precaution of firm compresses, tight bandage, a tourniquet put lightly about the limb to secure the patient from any deadly hæmorrhagy, and the appointing of attendants well accustomed to such a charge.

The mammary or thoracic arteries, though small and apparently unimportant, produce often the most distressing consequences when wounded, and require a bold operation. This arises from the looseness of the cellular substance which surrounds the great vessels and nerves in the axilla, and such is the power of these long and slender arteries over the cellular substance, as to drive the blood freely under the pectoral muscle. The aneurism which one of these vessels forms is as large sometimes as that of the thigh! It often happens after a wound of the thoracic or external mammary artery, that the whole side is blackened with the suffusion of blood; the great cavity of the axilla itself is filled with blood (and it is capable of containing a great quantity), the back and breast are black with the ecchymosis. The appearance is so formidable that the surgeon suspects some mortal wound; the side is so loaded with blood that the patient is oppressed, and he labours so in his breathing, that we should believe him wounded in the thorax, but that there is no cough nor blood coming up from the lungs, nor emphysema from air issuing by the wound. From the size of the aneurism in the axilla, one would, on the other hand, be apt to believe the axillary artery itself wounded, but that the pulse at the wrist continues firm. When the axilla is thus filled with extravasation, and the back and breast blackened with ecchymosis, a gangrene of the skin must sooner or later ensue; the discharged blood will become foul and very fetid; the destruction of cellular substance and the irregular abscesses must extend far and wide; the disorder will be several months in being cured; it arises from ignorant surgeons thrusting their stoppels of lint into that wound, which is very distant from the place where the wounded artery lies, which of course continues to bleed within.

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* Upon injecting the amputated limb, the wound was found to be in the posterior tibial artery. It had been cut entirely across by the ball; the upper end indeed had, by some accident, closed up; and at the final hæmorrhagy, perhaps also at many of the former hæmorrhages, had come from the lower end of the wounded artery, the blood having returned freely by the inosculations of the foot and leg.

This must be prevented. It would no doubt be very wrong to cut up the axilla, or touch the pectoral muscle in pursuit of every trivial artery that may be wounded on the fore part of the breast; nor would it be sensible to make incision always when the long pectoral artery itself is wounded; for often the thoracic arteries, when wounded with swords or musket shot, bleed very smartly, and yet stop of their own accord, upon applying merely a piece of lint to the wound. Indeed it is not on account of the actual wound of the artery that we perform any operation, but to prevent the destruction of the cellular substance and the diffusion of the blood; therefore when you find that applying a piece of lint with slight compression stops the bleeding, without any appearance of extravasation, you remain satisfied. But if you be called to your patient a few hours after the first dressing, on account of an incipient swelling and slight oppression of the breast, and find that the extravasation among the loose cellular substance in the armpit is begun, you must undo your bandages, withdraw your bit of lint, which is merely a stopple confining the blood, dilate the wound, put in your finger and advance it till you feel the jet of warm blood; hook out the clots which lie over the mouth of the artery, and lay your compress directly upon it. Then pile compresses over it on the outside and apply your roller; for it is seldom necessary to cut the wound entirely up, or to use the needle in wounds of the thoracic artery.

In the time of Belloste surgery was ill understood; he was a sharp remarker, and we have numerous instances of misconduct mentioned in his little book. Among other cases I find the following: "If at first we join the lips of a wound and apply astringents upon them, the outward bleeding may be depressed before that of the vessels is restrained, and so the blood running betwixt the muscles may there be corrupted, and may spoil the parts wherein it is contained and those that border upon them, and may also occasion suffocation and a gangrene. This is what I saw at Turin befal the Baron de la Serra, a gentleman of Savoy, who was wounded with a sword near the right armpit, and had a branch of the vena subclava opened. He was dressed by a very expert surgeon, who, whether by chance or otherwise, neglected to apply astringents to the aperture of the vessel, though the bleeding was very great. The wound was joined, and the part loaded with astringents, which were made fast with compresses and bandages. In the meantime the blood continued to run from the vein and to diffuse itself between the muscles of the breast. Two or three days past before the first dressings were taken off, and then the thorax was found to be gangrened; the wounded person died in a little time after." Here then I conclude my observations on this diffused aneurism.

RULES FOR STOPPING THE HÆMORRHAGY, FROM ALL SMALLER ARTERIES.

1st. Stypties can avail us very little in any dangerous hæmorrhagy, and they stand in our list, chiefly because they were valued by the older surgeons, who, though they used the needle, never could rid themselves of all their prejudices, nor use it freely.

With us styptics are little valued, we never think of using them, except in bleedings from arteries of the very smallest size, and when we have no hope of uniting the wound by adhesion; for it will be readily understood that those styptics are far from disposing a wound to unite. We do not use them where we see the bleeding artery, or where we can use the tenaculum, or needle, or even the compress; we find them useful, chiefly in oozings of blood from hollow passages, as in bleedings from the nostrils, the gums, the throat, the alimentary canal, or womb; or in bleedings from foul ulcers, from the cavities of deep sores, or from any broad and diseased surface, where the bloody exudation may be checked, and the condition of the surface improved at once, by the stimulant nature of our styptics. The best of these slighter styptics are diluted vinegar, spirits, mineral acids, or solutions of alum, and the muriated tincture of iron.

2d. There are also cases, where we should choose to disregard the bleeding from the smaller arteries, even though they be of such a size, as to be seen throwing out their blood by jets; indeed, we perform few operations, in which we do not see little arteries throwing out their blood, which before we have finished our incisions, have shrunk, and have so injected the cellular substance round about them, that it is thickened, and their mouths are closed; such arteries are no more troublesome, and the cure goes on well *. In like manner, in wounds, and in operations also, we often see little arteries opened, which we disregard altogether, allowing them to exhaust

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* See a former Note on this subject.

themselves; we keep the wound exposed to the air, and when the bleeding and general oozing relents a little, we clean it, at least we clear away the grosser clots of blood, which might prevent its re-union. Then laying the lips of the wound together we place our compresses in such a manner, as to press the lips of the wound against each other, and likewise against the bottom of the wound; so that these compresses, which thus procure the adhesion of the wounded surfaces, prevent, at the same time, any further bleeding within. The bandages of such a wound ought to be painfully tight at first, and may be slackened in a few hours.

3d. In all hæmorrhages, where we have a full and rather a dangerous bleeding, and in which we see distinctly one or two great arteries or veins throwing out blood, the bleeding must be suppressed either by the ligature or by a steady compress, and the ligature, wherever we can use it easily, ought to be preferred.

4th. If an artery of a smaller order, and lying firm against some bone, as in the hand, or foot, or temple, be cut; if either by a punctured wound a small aneurism be formed, as in the wrist or at the root of the thumb; or if by a blow the artery be hurt against the bone and bursts, so that a small beating aneurism ensues; we do not, in such case, always go regularly to work, we do not choose to give the patient the pain of opening such a tumor; but sometimes by departing from the general principle, we manage the particular case more easily; we apply a compress, which being tied down hard and firm for two or three days, obliterates the artery, by pressing it against the bone. The blood of such a trivial aneurism is as easily absorbed as that bloody tumor which we see so often on the heads of children immediately after birth, and which we are accustomed to disregard. The compress is like that with which we stop the temporal artery, after opening it with the lancet.

5th. The manner of making compression to obliterate an artery must vary according to the circumstances of the case: Sometimes, as in small and superficial aneurisms, it should be made above the skin, and on that part of the artery where it enters the small aneurismal effusion; and the artery which feeds the aneurism being thus obliterated, the blood already extravasated will be absorbed, and the little tumor itself will quite disappear, leaving but a slight thickening, or perhaps none. Sometimes, as in wounds, we make the compression within the wound; and for such a purpose there can, perhaps, be no better nor firmer compress than a small pellet of chewed paper, a piece of cork, a piece of folded leather, a piece of firm sponge or agaric, or a firm compress of folded linen; any thing, in short, will do for a compress, if it be but firm in itself and neatly applied.

The compress thus introduced into a wound, and placed upon the mouth of the bleeding artery, must unavoidably interrupt the cure by adhesion, but this is only for a few days; for when it is withdrawn on the second or third day, the parts may then be laid together so as to adhere.

6th. But the arteries of the wrist, the palm of the hand, the fore part of the foot, &c. are of so great a size, that though when bruised, or hurt, or stabbed, and the skin healed over the wounded vessel, the aneurism is commonly of a trifling size and easily cured; yet in open wounds where these arteries are cut by working tools, a carving knife, &c. in the wrist or the foot of a large and strong man, there ensues a scene of terrible confusion and perplexity; which perplexity is itself the chief cause of such loss of blood, as often injures the constitution, when it does not endanger the life: for the friends gather up napkins and cloths confusedly, wrap them loosely and in a hurried way round the limb, and each cloth, as soon as it is soaked in blood, they remove, as if they had no other intention than the childish one of hiding from the patient what quantities of blood he is losing! while, if instead of this general compression of cloths wrapped irregularly round the limb, they could have but the boldness to look upon the wound, and press upon the very point where the artery is bleeding, they might, with one finger only, suppress it, and with a single touch. Then, let the recollection of this be a lesson to the surgeon, and let the very sight of this confusion put him in mind of his duty, which is to strip off these confused bloody cloths as quickly as possible, and press the point of his thumb or finger directly upon the bleeding vessel.

7th. The bleeding being thus restrained, let the surgeon clean the limb, appoint his assistants, lay the hand upon a table and pillow; or if it be the leg, lay it out firmly upon a stool. If he have no good assistant, let him make a temporary tourniquet with a common garter and a piece of stick; but if he have any professional man to help him, then he should still prefer the suppressing of the bleeding with the point of his finger, because in a moment he can let go the artery and can close it again as suddenly; in short, he can let go the bleeding artery more quickly, and can look at it more frequently, and with less loss of blood, than in using the tourniquet. Having thus fixed his eye upon the bleeding artery, he either draws it out with the tenaculum or forceps, or he strikes his ligature under it with the needle; or if neither of these can be done, he puts either a regular tourniquet or this occasional tourniquet round the arm, and enlarges the wound, and opens the fascia freely, till he sees the artery bleeding with open mouth.

[No doubt before he does this he will take care to recollect his anatomy, the point of bone, the tendon, which should be his mark to find the artery, and he should reflect on the place of the nerve; and if it be near the artery he should take most particular care to have it put aside, and not included in the ligature *.]

8th. Whatever blood the patient loses before a surgeon arrives, is part of the natural danger of his wound; but it is a great disgrace to the surgeon if he lose much blood afterwards. Successive bleeding, successive divings with the needle, the taking in of arteries, tendons and nerves, all in one great ligature! and hæmorrhagies still succeeding to these clumsy operations, are far from being honourable to the surgeon; especially since these wounds of the fore-arm, or leg, or hand, or foot, are in parts where we may use greater freedom. The surgeon, then, should do his operations boldly; he should not be sparing in his first incisions (if he have but knowledge enough of the cross ligaments, tendons, and nerves, to make such incisions safely); for if once he suffer this wounded artery to assume an aneurismal form; if he

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* Note by Mr. C. Bell.

oppose the blood by slight compresses, permitting it all the while to bleed within; the artery will shrink, the cellular substance will be crammed with blood, and the skin thickened also by inflammation. The seeking out of the artery among such a confusion of parts will be inconceivably difficult, both because it does not bleed so as to direct us, and because it lies deep, and because the surgeon cuts very timorously; for even a bold man will be apprehensive when he finds himself cutting through parts which he does not understand! and, in this particular case, the parts are so massed together, that he cannot distinguish one part from another, unless he prolong his cut either above or below the place in which the blood is extravasated where the arteries are free. In short, as he cuts through a great depth of confused substance, and on so naked a part as the wrist (e. g.) he hardly doubts that he is cutting through muscles and every thing, while in fact he is cutting only through the skin, thickened to this degree by inflammation that has lasted for two or three days, and by the continual driving of the blood.

The rule which arises out of this representation of the case is very plain, viz. not to be sparing in the first incision; to do this first and great point of the operation decidedly. The leaving no doubt about the tying of the artery, and no possible occasion for future incisions, is in the end the greatest saving of pain; the first operation is easier than the second, and the second operation is easier than the third. It is owing to this misplaced lenity of making small incisions at first that any second operation is ever required: it is owing to a want of still greater boldness in the second operation, that a third is ever required;

and we know too well how often a want of success in the third or fourth operation has tempted the surgeon to cut off the limb *.

9th. The sponge is often more useful than the needle, and that, too, in cases of the greatest danger. Wherever the wounded artery lies deep, and we cannot cut for it, on account of the nearness of some great artery or important nerve, as, for example, in the axilla, about the neck, or about the angle of the jaw; wherever the bleeding artery is so nitched in between two bones that we cannot draw it out with the tenaculum, nor reach it with our crooked needle, as, for example, in the fore-arm, or between the bones of the leg; in short, wherever we cannot see the artery, or cannot strike it safely with the tenaculum; wherever the bleeding is not so much from a particular artery as from a general surface; or wherever the blood is thought to flow rather from great veins than from arteries (as in tearing out cancerous glands from the arm-pit); in all such cases we use the sponge, and we use it in the following manner: We keep the sponge dry and hard compressed, and always ready for use, and when it is to be used, it is cut into small

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* It cannot be superfluous to remark here, that those who have the brachial artery tied, as in aneurism at the bend of the arm, recover the pulse of the wrist, but that those who have the radial artery itself wounded have no pulse at the wrist. The compression obliterates always a considerable extent of the artery, and the ligature itself obliterates the canal of the artery for some space above and below that where it is applied.

I once dissected a patient who laboured under paralysis of one side; the pulse in that arm was entirely wanting. This very singular accident gave rise, before the patient's death, to many ingenious speculations, not unlike the lucubrations of the celebrated Haller, in his thesis "On the Influence of the Nerves over the Arteries;" but the man died. I dissected his arm, and found the artery obliterated from the middle of the arm through the fore-arm and wrist.

pieces, square or long, as the incision requires, and small threads are tied to the sponges, by which they may be drawn away in due time. In any dangerous hæmorrhagy of this kind, we choose out a piece of sponge proportioned to the size of the wound, thrust it down to the bottom of the wound, fix it there with the point of the finger, either expressly upon the mouth of the bleeding artery, or if that cannot be distinctly seen, upon the place at which the artery bleeds; then lay one compress above the sponge, a second compress above the first, a third above the second; and taking care to keep the compresses always steady with one finger, to prevent the blood soaking into the first sponge, and distending it, we pile one compress above the other, till the whole rises so above the level of the wound, that our bandage operates well upon the whole of this pile, which is called the Graduated Compress.

I advise you, on such occasions, when it is practicable to keep your tourniquet screwed during the whole operation, that you may not be troubled with blood; to slacken it slowly, that the dressings may not be discomposed by the too sudden return of blood; and still let your tourniquet remain loose about the limb, and ready to be screwed if the artery should bleed again.

Yet once more, before I forsake this subject, I must endeavour to impress you with a conviction of the danger of entering upon the profession of surgery (where all the most alarming accidents and trials come upon you suddenly) without a perfect knowledge of anatomy. From the earliest times this has been the conviction of the most eminent men; this is indeed a subject on which I should choose rather to argue from authority, than to quote invidious facts. I should not choose even to remind you of the murders which are related in books of the rude Arabian surgeons, yet that surely could give no offence. Albucasis, in the preface to his book of surgery, relates many. He himself saw an ignorant surgeon, in opening a scrophulous abscess in the neck, cut the arteries, so that the woman fell down dead under his hands. "Surgery," says Albucasis, "has fallen to a very low state. The art has in these regions degenerated, it is almost forgotten; and this is the reason why no good operators are found! Our art is difficult, and should be attempted by no one who is not exercised in the science of anatomy as taught by Galen, till he knows the forms and articulations of the several members, their bones, nerves, sinews, with the place and number of each, and the course and egress from the body, both of the pulsating and of the quiescent veins." Every artery, indeed, should be thoroughly known to the surgeon, from the smallest, which are stopped by lint or compression, to the greatest, which form the aneurism of the arm or thigh! from the arteries of the wrist or temple, which you can hold with the point of one finger, and catch with the needle easily! to the arteries of the groin or arm-pit, which bleed so, that the patient can hardly be saved by the most rapid and dexterous operation.

DISCOURSE VIII.

WOUNDS OF THE BREAST.

HAVING passed through all the intricacies which belong to the general treatment of wounds, we now advance to the more plain and easy doctrine of individual wounds: and in discoursing upon wounds of the thorax, it is natural, first of all, to reflect upon the very important parts which are contained there,—the heart, the lungs, the great vessels, the thoracic duct: We cannot but wonder, that wounds of such a cavity should not be always mortal; but still more must we be surprised at men escaping easily from the most desperate wound of the lungs; surviving for many hours, or even days, where the weapon had absolutely touched the heart itself. But wonder is ignorance, and as our knowledge advances wonder subsides; for in a subject like this, we compare the structure of the parts with the consequences of the wound, so as to arrive by slow steps at a knowledge of the true proportion betwixt the wound and the dangers; and all that was wonderful at first, vanishes in the end.

We know that the chest contains the heart, the lungs, the great arteries and veins. We know that if the heart or great vessels be wounded, there come on coldness, fainting, oppression, a total sinking of the pulse, paleness, and death; that if the lungs be wounded, there is an emphysema, or a breathing of air into the cellular substance, spitting of blood, difficult breathing, suffocation, and death; and if the patient outlive the danger, we expect pains in the chest, distress in breathing, dreadful cough, spittings of blood, restless nights and fearful dreams; and there will be, from time to time, hopes of recovery, followed by frequent relapses, threatening death; and we are, besides, during all this suffering and pain, obliged to use bleedings, so profuse as to be almost as dangerous as the wound itself.

If still our patient escape these early dangers, there are others, slower in their progress, but perhaps not less to be feared. There come next long suppurations of the chest, with discharges of broken ribs; then the wound swells, and the matter is confined; then a deluge of matter bursts out at last after long oppression,—it bursts out with a temporary relief; but the discharge continues so profuse, that weakness, fever, confirmed hectic, ensue, which hectic, unlike the true consumption of the lungs, is yet sometimes cured.

Sometimes also it happens, that the outward wound heals when all is not sound within: then matter forming oppresses the lungs, and the patient labours so much in his breathing, that if the making an opening for that matter either be not proposed, or be not allowed, it collects in such quantity, that the whole breast is disordered and oppressed, and the patient dies.

Thus we have before us in one view all the dangers of wounded lungs; oppression and suffocation at first; after that, high inflammation and pain; then long continued suppurations and wastings of the lungs, so that a small bud or tubercle only is left of them; and in the end, great oppressions from effusions of matter or of blood. We feel that wounds of the lungs are most interesting, from their dangers; from our seeing the cause of danger so plain and open; from our giving such immediate relief, sometimes by a bold use of the lancet, sometimes directly by the immediate touch of the knife.

I have already hinted at a thing really wonderful, that the thorax, containing the heart, lungs, and great vessels, should be so often wounded with so little danger. Many no doubt die, but numbers escape; for a wound of the substance of the lungs is far from being mortal. The blood may suffocate the patient; the fever and pain may waste him; he may die of the inflammation or of the oppression of the lungs; or there may be time for a large suppuration, or a lingering hectic to cut him off; but still, if his wound be only in the edges of the lungs, he is in some degree safe; he is only in danger when the thick substance of the lungs is perforated, and falls into abscess, or when the root of the lungs is wounded, for there the great vessels of the lungs being opened, the great effusion of blood, like that from a wound of the heart itself, must kill, even by the quantity of blood lost to the general system; but besides, this blood being thrown into the trachea, deluges the lungs, the patient spits up a frothy blood, blood instead of air occupies the lungs, so that he struggles for breath but a few moments, and then expires.

But still I return to the first part of this proposition, that which ought to be the most particularly impressed, that though no doubt many die, numbers do escape; they often recover from wounds of the bayonet or small sword; many recover also who have been shot fairly through the thorax, with fractures of the rib both before and behind, with many dangerous splinters of bone driven in upon the lungs; some of those wounded with the small sword have hardly been ill, or have recovered in a few days; and even those wounded with balls across the chest have recovered in a month.

When the lungs are wounded, the distress and danger of your patient must arise either from emphysema,—or from extravasation of blood,—or from the ball,—or cloth or splinters of the ribs, either lying in the cavities of the thorax, or absolutely sticking in the lungs: but besides these present dangers, there is a second train of dangerous symptoms, which you must also learn to manage, especially long continued suppuration in the breast,—callous sores,—exfoliating bones,—or (the wound having actually closed) there may be collections of pus within the chest, and the operation of empyema may need to be performed. If I should discuss each of these points, I think that you would be bold and skilful in managing such a case.

I.—*Of Blood poured out into the Cells of the Lungs.*

When a man is shot through the lungs, if death be very near, it must be from suffocation; and you will find him with a bloody foam at his mouth; his face pale in the cheeks, and livid round the lips and eyes; heaving the breast with intolerable anguish; tossing from side to side in bed; the bloody foam increasing; the breathing becoming more difficult, and the blood and air rattling in the throat; then the pulse flutters, and the extremities continually grow colder, till (struggling, in something like a convulsion) he expires.

If you find your patient spitting blood and breathing high, but not much oppressed, or his oppression increasing very slowly, you may hope to save him. If there be no great vessel wounded in the lungs, so as to suffocate him at once, it is probable that the smaller vessels which are opened by the wound will gradually cease to bleed; and after four or five days of alarming cough, with bloody expectoration, that symptom will cease; and in order that he may the sooner be relieved from his danger, you must bleed very freely: let it be your intention to reduce him very low by quick bleedings; and let these bleedings have the effect of continued internal hæmorrhagy, without the dangers of it: let them depress him to the same low condition to which the inward bleeding would most likely have brought him; and the system being emptied in this direction, there will be less danger of immediate suffocation in the lungs, and but little fear of the succeeding inflammation rising too high. It is only by these repeated bleedings that the patient can be saved: you must keep the vascular system low in action, and so drain it as to prevent the lungs from being oppressed with blood.

One thing is very clear, that, if you bleed only when the cough and bleeding from the lungs return, you never can do wrong; for this is the plain matter: The patient, lying struggling before you, is to lose a given quantity of blood; if it be allowed to flow out into the lungs, he may be suffocated; if you draw it from the arm, this suffocation is prevented; if you keep him low enough by bleeding, there will be no blood to spare for this extravasation into the lungs; if you bleed only when the bloody extravasation returns, you are taking no blood away but that which you cannot save; and thus you see, that it is only the most profuse bleeding that can keep your patient from suffocation; and that will be established in your mind as a rule of sound practice, which seemed shocking and dangerous, when mentioned in explaining only the general nature of wounds; you will feel, by such cases, that the French surgeons (with all their partiality for bleeding) could hardly, in such a case, go too far.

II.—*Of Blood poured out, not into the Cells of the Lungs, but into the Cavity of the Chest.*

The next cause of suffocation is blood thrown out into the cavity of the thorax, not into the cells of the lungs,—it is less dangerous and more easily relieved; and it may proceed from one of two kinds of wound, either from a fractured rib having torn the intercostal artery; or from blood coming, not thus from the walls of the thorax, but from the lungs, which often bleed out into the thorax, as well as upwards into the throat.

If the blood which oppresses the lungs come from the lungs, then it is attended with a foaming of blood at the mouth, and a continual cough; if it come from the intercostal artery only, then there is no coughing of blood, but an oppression increasing every hour. In either case, the patient is in a melancholy condition; and indeed this oppression from blood, merely, gives him all the appearance of one who is wounded in some of the great vessels, and soon to die. The patient, in a few minutes after he is wounded, begins to be oppressed; he cannot lie down; he sits in bed, raised up with pillows; he often starts up in great agony, crying out that he is suffocating: he draws his breath with great contortions and writhings of the body, with anxiety and fear of instant suffocation, such as cannot be described; he draws his breath with contortions and great effort, and yet receives not half his quantity of air; his voice begins to be obstructed, his face becomes livid, his eyes turgid, his extremities cold, his pulse oppressed, quick, and fluttering, there is a rattling in his throat, and his forehead is bedewed with a clammy sweat.

If the patient be not in the hands of a skilful surgeon, he will surely die. But when the surgeon thrusts in his finger, to search the wound, he feels hot blood; it follows his finger; even the getting out a little blood in this way is a relief, and the patient is fully relieved by a more regular emptying of the thorax. Often, the surgeon seeing that blood follows the finger, and being sensible of the true cause of this oppression, brings his patient over the side of the bed, as in tapping for the dropsy, makes him support himself upon his hands, and hang with his head reclined; by this dependent posture the blood issues from the breast, and he is for the time relieved, breathes more calmly, returns to bed, lies quietly down, and continues in tolerable ease for twelve hours, till, perhaps, the blood, flowing from the wounded artery, fills the cavity of the thorax slowly, and the breathing becomes again difficult in proportion as the breast fills: he is again put into this distressing posture, and again the thorax is emptied of its blood; and thus, from dressing to dressing, he is relieved and kept safe from suffocation, till at last this inward bleeding ceases, and allows the wound to close.

It is not merely the laying the patient in this posture that will relieve the breast; the blood flows with extreme difficulty; sometimes coughing, or the patient's endeavours and strainings help to empty the chest, the putting the finger into the wound always assists; the flowing of the blood is made extremely easy when a large canula is introduced into the wound; any tube that is most at hand will serve; on many occasions, the surgeon has found even so small a tube as the catheter of use. But why should so harmless an operation as this be spared? let a large canula be introduced into the wound, at every dressing every twelve hours, oftener if the breathing be oftener oppressed, and repeated daily, till the blood, becoming gradually paler, ceases to flow. If a ball have passed through both sides, the danger and oppression will be very great; and both sides of the thorax must be freed of blood. If the oppression come on instantly, there is danger lest some great artery be wounded; if it come more slowly, but at last arrive at that degree which the patient can no longer bear, it is clear, from the slowness, that it is some smaller vessel. If there be oppression of the breast, without bloody expectoration, the bleeding is from the intercostal artery only, and there is no wound in the lungs.

Whatever may be the cause of this inward bleeding, these are your rules: First, put in your finger; perhaps it may discover, or may evacuate the blood: —If the blood do not follow the finger, then some tube must be introduced, and the tube, for so simple a business, need not be a nice one. When the blood is coagulated (which it often is), such attempts will be unsuccessful. If you cannot get your tube into the thorax, and the breathing continue oppressed, you must enlarge the wound, and enlarge it freely. To be afraid of exposing the lungs to air, when they are already torn with a bullet and loaded with blood, is mere childishness and useless theory, very unlike the proper management of such wounds. If you find the wound in the thorax too high above the third or fourth rib, and if you find that no postures of the patient, however willing or able to turn himself, will bring the blood easily in that way; or, if you find the wound confused, oblique, and difficult for you to dilate, you must do an operation which, as it is commonly practised for pus in the breast, is called the operation of empyema; that is, you must make a very free incision in the line betwixt two of the ribs, then puncture the pleura with a lancet, and introduce your tube there; or, in plain language, whenever you find that the natural wound will not empty the thorax, you must not fear to make a new wound, and you will make it in what is called the chosen point, the point of election; *i. e.* low, betwixt the seventh and eighth rib, that there may be an easy drain. But, whenever the shot wound is about the middle of the thorax, dilate it rather, which both changes the nature of the wound and gets out the blood. When this blood proceeds from a wound of the intercostal artery, such free incisions are the more necessary; they allow us to see the artery, to feel the jet of its warm blood, by putting in the finger, and this allows us to press it with a compress, or to tie it with the needle and thread.

III.—*Of Emphysema, or the Tumor formed by Air blown out from the Lungs into the common cellular Substance, or confined within the Thorax and oppressing the Lungs.*

The emphysema is very frequent after fractures of the ribs, and sometimes follows common wounds.

It arises from the air escaping, first, from the lungs into the thorax; then, from the thorax, through the wound of the pleura made by the fractured rib; then, from the cellular substance, which is over the rib, passing along till it inflates the cellular substance over the whole body. It is more frequent after a fractured rib, because there is there a wide laceration of the lungs, and no exit for the air; it is less frequent in large wounds with a knife or broad sword, because the air has an open and unimpeded issue; it is again more frequent in deep stabs with the bayonet or small sword; and it is peculiarly frequent in gun-shot wounds, because the orifice in the skin inflames and swells, while the wound is wider within. We often find an equal degree of emphysema at both wounds, *viz.* that where the ball entered, and that by which the ball passed out, and we need to make scarifications at each wound, which we do the more willingly, because such scarifications empty the windy tumor of its air, and, if necessary, they can be made such as to empty the thorax of blood, or to give room for searching with the finger, and extracting the splintered bones.

This emphysematous or windy tumor is one of the strangest accidents that happens in wounds of the chest: it advances so quickly, swells the whole body, closes the eyelids, puffs up the scrotum, and all the looser parts, with such alarming rapidity, and is attended with such oppression of the breathing, as to terrify the patient; and the surgeon himself, though he knows it to be a slight matter, compared with the apprehensions of the sufferer, is yet not entirely at ease. In short, it is a symptom which is so particular, and in some circumstances so dangerous, that it requires a very full explanation.

When a rib is broken, the point of the broken bone is pressed down upon the surface of the lungs and touches them: it abrades and lacerates the surface by the continual motion of the thorax; and it is often from the slightest and most superficial wound of this kind, that the emphysematous tumor proceeds; for, in most cases of emphysema, the laceration of the lungs is so superficial, that it is not even attended with the least degree of bloody foam from the mouth, or any other symptom of a deep wound; and, if the patient die, the wound cannot be seen even after dissection, but is only to be found by inflating the lungs. Yet the surface of the lungs being touched, even in this slight way, the air escapes from them at every inspiration; the air, which is then within the cavity of the thorax, is of course compressed, so that, at the next expiration, this compression must force the air either back again into the lungs, or out by the wound in the walls of the thorax, and so in among the cellular substance which surrounds the broken rib. Thus in every inspiration there is a suction of some air, which is drawn through the wounded lungs, the air expands into the cavity of the thorax, the lung which gave out that air subsides again, and lies almost entirely quiescent, partly from the wound in it, which, like a rent in a bladder, prevents it being inflated, and partly from the oppression of the air within that cavity, where there should be a vacuum to cause its distention; so that, in the first inspiration, air is drawn in through the wounded lung, in the next inspiration it is breathed out through the wound of the thorax. Every new inspiration draws more air from the wounded lung, and every new expiration drives more air out into the cellular substance;

there is no further outlet for the air, which makes its way forwards, undermining the common skin with wonderful rapidity; so that the emphysematous crackling tumor appears, first, over the broken rib; then extends over the whole chest (oppressing the breathing), then over the neck and face, filling particularly the eyelids, so that the eyes are absolutely closed; then over the belly; then down the thighs; the private parts are at last enormously swelled; and no part escapes this tumor, except the palms of the hands and the soles of the feet: more air is every moment drawn out from the wound of the lungs, and driven under the skin; the patient is every moment more and more oppressed; till at last the breathing is quite interrupted, the pulse flags, the extremities grow cold, and the patient, if he be not relieved by some operation, must die.

The philosophy of this disease, if I may be allowed to say so bold a thing, is quite misunderstood; and it happens very strangely, that the most palpable blunders are to be found in the writings of those who are looked up to as oracles on this point, and who boast of their discoveries, and claim them, as their own, with an eagerness which would imply something very important. But perhaps the easiest form in which I can deliver this question to you is, by explaining, first, in my own way, the real condition of a wounded lung.

The moment that the lungs are wounded, they fall down, and continue in this collapsed state until the wound heals, which it does in the course of a very few days. From that moment the use of the wounded lobe is lost, so that if the wound be in the right side of the lungs, the breathing is performed only by the left, only half the quantity of air is inspired, and the breathing is difficult. But this collapsed state of the lungs, which cannot be remedied, which must inevitably continue, at least for a few days, while it is a cause of distress, is at the same time a chief means of safety. When the lungs are unfolded, their vessels have their full diameter, they hold their full proportion of blood, and if, after being wounded, the lungs could continue dilating at every respiration, their wounded vessels would throw out much blood; but, the moment that they are wounded, they fall down to the back bone, they continue in this collapsed state, and can no more be filled than a torn bladder can be inflated; and, moreover, they are oppressed by the thorax being filled within with blood or air, and this collapsed condition of the lungs prevents much loss of blood. There is less blood thrown out into the cavity of the thorax to oppress the lungs, and there is also less thrown into the bronchii, which is still a more dangerous kind of bleeding, since it threatens suffocation, not only by filling the wounded lung with blood, but by affecting both sides of the lungs.

If the lungs, when wounded, were to continue in perpetual motion, I do not know how we should expect a cure; for the air would be continually streaming through the wound, and the wound itself, alternately dilating and contracting like that in an artery, could not heal. But as the wounded lung lies in a collapsed state, the edges of the wound are in contact with each other. There is, as we find by dissection, a slight effusion of blood, a degree of livor, a swelling, thickening and inflammation round the wound, and thus, in two days, the wound heals.

It is healed partly by adhesion, partly by this thickening of the cellular substance round its edges; and thus the lung becomes once more entire, and its function is restored.

The blast of air, from a wound in the thorax, is often so strong that, at every breath, it will extinguish a candle, and rushes out with considerable noise. This strong blast of air, so far from being a sign of wounded lungs, is often strongest when the lungs are absolutely entire; it is a sign of a free and open wound in the thorax, but by no means of wounded lungs; for, whether the lung be or be not wounded, the air enters so freely by the outward wound that there is no vacuum formed to give them play, and therefore they fall down and lie collapsed till the outward wound heal. The thorax therefore has nothing to do with the lungs, but is like a pair of bellows, having a large air-hole, which admits the air every time the breast rises; and when the breast falls again, that second motion blows it out. The air is alternately drawn in, and thrown out at every respiration, with a strong blast; but whatever air issues through the wound, had been drawn in by the wound, and had never passed through the lungs. There is no vacuum to move the lungs. The lungs, whether they be entire or whether they be wounded, always lie collapsed.

That the lung of one side, which remains unhurt, is sufficient to support the system, we learn from various accidents: from those cases in which, either owing to the incisions made by the surgeon, or to the nature of the wound, the chest has lain quite open, and the lung on that side quite collapsed, and where the patient has yet lived in tolerable ease in the mean while, and recovered perfectly in the end. We learn it also from cases of emphysema, where the lungs are oppressed with air, and from cases of empyema or pus, within the cavity of the chest, obstructing the expansion of the lungs; and especially we are sure of it from the very gradual decay of those who die with large suppurations within the chest, in whom we find, after death, that on one side there remains nothing but one small knob or tubercle of the lungs.

That the breathing should be easier in a free and open wound of the chest than in a punctured wound, or that in the case of a punctured wound, the patient should be relieved by a free incision, no one needs wonder; for, in a punctured wound, there is no way for the blood or air to escape from the thorax, while yet, at every stroke of respiration, more and more blood and air are drawn out from the lungs, till at last the blood, and especially the air, are so condensed, that they not only oppress that side of the lungs, but by hindering the free play of the diaphragm, and loading the mediastinum, they oppress also the other lung, until at last the breathing, every moment more oppressed, falls lower and lower; the pulse also sinks in the same proportion; the extremities grow cold; cold sweat bedews the forehead; and, after great tossing and undescribable anxieties, the patient dies. But, in a free and open wound, or when we make a free and open incision, to relieve this distress, we relieve not the oppressed and wounded side, but the sound side of the lungs, and all goes on tolerably well, till the incision heal, and the function of the wounded lung is restored.

If this reasoning be just, then, instead of trying to get out the air, or hoping to restore the office of the lungs, we should wish the lungs to lie in this collapsed state; it is the best security against dangerous bleeding, their evolution is not absolutely necessary for the patient's breathing, their continuing in this collapsed state is the surest means of healing the wounds in them. In short, this collapsed state of the lungs is one of those happy accidents, inseparable from the constitution of the part, which so obviously facilitates the cure, that we attribute it to a regular and fixed design of nature.

How impossible it must be to raise the wounded lung, and to renew its function, I think I shall now very easily explain, demonstrating to you, at the same time, that those who have intended this effect by their free incisions, had not founded their discoveries, as they have prematurely called them, on good principles; for Bromfield writes very ignorantly in that chapter, where he tries to claim the invention from Hewson. Hewson, again, is as vain of this trifle as if he were not rich in discoveries really honourable; and Mr. Benjamin Bell, the most excusable of all, follows them in the humble labour of gleaning and gathering up their mistakes.

First, then, Mr. Bromfield tells us, with great confidence in his own opinion, and great scorn of all others, "That the wound of the lungs being ascertained, one would not imagine that any person, skilled in the true cause of the complaint and in the danger, with a thorough knowledge of the parts, could be at a loss for an attempt to relieve; for, in case an opening is made between the ribs, and a canula introduced, whose diameter is larger than the wound of the lungs, the air will be forced out as fast as it escapes from the lungs, therefore the lungs will have room for their expansion, and the danger of suffocation will be removed; and when once the wound of the lungs is agglutinated, and the canula withdrawn, the external opening will be healed without any difficulty*." The notion of the thorax being exhausted of air, before, according to the author's expression, the wound of the lungs is agglutinated, is curious. The expression, "the lungs having room for their expansion," is still more curious; but if any one should doubt whether the author could intend to say so foolish a thing, as that the lungs, not being opposed, will dilate of their own accord, let him turn over to the next page, where he will find a remark, coupled with a fact, which is most curious, viz. "I remember a similar happy effect, in accelerating the cure in a similar case by the patient's playing on the hautboy, which, keeping the lungs forcibly distended for a long while together, kept the pleura closer to the ribs, so that the union of the separated parts (viz. of the pleura and ribs) was most likely sooner effected than if he had trusted to the ordinary respirations."

The celebrated Mr. Hewson hardly reasons more correctly than his competitor, Mr. Bromfield†, who so kindly permitted him to make himself known to the Society. "It is natural," says Mr. Hewson,

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* Page 91.

† Mr. Bromfield says, very candidly, "Though I should have been sorry to have prevented Mr. Hewson's making himself known to the Society, by a remark which he thought new," &c.; but Mr. Hewson had many ways of making himself known to the Society, which Mr. Bromfield had nothing to do with. He was among the number of those who shared the merit of that most beautiful of all discoveries, the Lymphatic System.

" to suppose, that the wound of the pleura and intercostals may sometimes be too small to suffer the air to get readily out into the cellular membrane, and to inflate it, but may confine a part of it in the cavity of the thorax, so as to compress the lungs, prevent their expansion, and cause the same symptoms of tightness of the chest, quick breathing, and sense of suffocation which water does," p. 374. Through all his paper we find him, in speaking of oppression of the lungs, referring only to that side which is wounded. He never once mentions the oppression of the diaphragm, or the pressure on the mediastinum, nor does he in any shape hint to us the oppression upon the lung which is sound; and, in the passage which I have just quoted, he says, that " the air within the thorax prevents the expansion of the lungs;" and, in directing how the incision is to be made, he advises that it be small, rather than large, " for penetrating wounds of the chest are inconvenient, on account of the air's entering by the aperture in such quantities as to prevent the expansion of the lungs." The tendency of all this is very plain, but it is only in the writings of Mr. Benjamin Bell, who has been busied in collecting faults from all other authors, that one can have a perfect abstract of this opinion, which all of them had some faint notions of, but which he alone has obtained in perfection. He says*, " In the chapter above alluded to, we have mentioned different methods of expelling the air from the surface of the lungs, but the simplest and easiest is this:—While the wound yet remains open, let the patient, in a slow gradual manner, make a full inspiration, by which a considerable quantity of the collected air will be discharged*. This being done, the skin must be instantly drawn over the sore, so as to cover it completely during expiration; and if the wound be moderately opened during inspiration, the whole quantity will be soon expelled." This receipt, for expelling air from the lungs, comes very naturally from the author, by whom we are told, in the chapter alluded to, "that when a violent exertion in coughing, crying, or laughing has produced it (viz. bursting of the lungs), the particular seat of the complaint will, in general, be pointed out by some degree of pain in the part where the rupture of the external coverings of the lungs has occurred."

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* Page 207.

Now, whatever interest this author may have in persuading his reader that laughing is dangerous, and that the lungs may be burst by immoderate laughing, I cannot forbear wishing that he had satisfied us so far, as to have mentioned at least one accident or fact of this kind.

"The other means which we wish to propose," says Mr. Bell, "for drawing off air from the thorax, is Suction. An exhausting syringe may be fitted with such a mouth, of ivory or metal, as will allow it to be closely applied over the orifice in the pleura."

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* My reader, although he should be the merest Tyro in philosophy, will know, that when a man inspires with a wound of his thorax, if that wound be larger than the trachea belonging to that side of the lungs, though he may by inspiring draw air into the chest by the open wound, he can throw none out; in short, inspiration must always draw in air, both by the opening of the chest and by the opening of the trachea, and expiration must blow it out, if it will go. Inspiration and expiration are the same, with regard to the opening of any wound, that they are with regard to the trachea, therefore Mr. Bell has just repeated a boy's lesson with a boy's fault in it, calling inspiration expiration, and expiration inspiration.

And again he says, "that as much distress has, on some occasions, ensued from both cavities of the chest being at the same time laid open, it ought never to be attempted." And the reason given for these inconveniencies, and the kind of danger that is apprehended, is not that the lungs of both sides would collapse, and breathing cease, and the man die, but it is this, that the two cavities of the chest being laid open at once, and the air being admitted into both cavities at once, both cavities would inflame at once, and that would produce "much distress." That it might produce much distress among his friends, I will readily allow; but as for the patient's own immediate distress, that, I believe, would be soon over, and there would be little time for relieving him by sucking up the air, with an elastic gum bottle, from "the surface of the lungs."

But the serious and plain conclusion is this, that the lungs will continue giving out air till they heal; that, while they are giving out air, they must lie collapsed; that it is not desirable that they should be moved, for their lying unmoved is the best security against bleeding, and the surest way of making the wound of the lungs heal. And, still further, we cannot, if we would, raise the wounded lung, nor renew its function; it is rent so that it cannot be inflated; it is oppressed with air, if the chest be close, or, if the chest be open, the air passes in so freely, that no vacuum can be formed to move the lungs; and, as for inspiration emptying and expiration filling the breast, it could never have been spoken of but by a person who could talk about the lungs being burst with laughing. The incisions, which have been so much commended, are useful, not by raising the wounded lung, or renewing its function, for that attempt is absurd in all respects; it is needless, because though a man does not live so easily, yet he does live, and does well with one lung only (I mean breathing only with the lungs of the one side) till his cure be completed. It is impossible to accomplish it, because the wounded lungs being still open, the matter, air, or blood, issuing from that wound, fills the thorax, and prevents a vacuum. It is useless also; for it is, as I conceive, desirable, that the lung should lie collapsed and quiet till the wound in it heal; and, therefore, those free incisions, which I approve of as much as Mr. Hewson could do, are useful only where the breast is much oppressed with accumulated blood or air; and the incision which lets out that blood or air, also lays open the thorax so as to let in the air freely, so that this free incision serves at once two good purposes;—it makes the wounded lungs collapse entirely, and sets the lungs of the sound side quite free.

The practice, then, in the case of emphysema, should be this:—First, Upon observing the crackling tumor beginning to form itself over a fractured rib, you should make small punctures with the point of a lancet, as in bleeding; and if the point be struck deep enough, the air will rush out audibly. But, as this air was in the thorax before it came into the cellular substance, it is plain that the thorax is still full, and that the lung of that side is already collapsed and useless, and must continue so. The purpose, therefore, of making these scarifications, and especially of making them so near the fractured part, is not to relieve the lungs, but merely to prevent the air spreading wider beneath the skin.

Second, If, before you arrive, the air shall have spread to very remote parts of the body, as to the scrotum, and down the thighs, it will be easier to make small punctures in those parts, to let out the air directly; than to press it along the whole body till you bring it up to the punctures which you may have made on the chest over the broken rib.

Thirdly, If, notwithstanding your free punctures, and your pressing out the air in this way, you should find by the oppression, that either air or blood are accumulating within the cavity of the thorax, so as to oppress, not the wounded lung only, which was of course collapsed and useless from the first, but so as to oppress also the diaphragm, and through the diaphragm to affect the sound lung; then a freer incision must be made through the skin and muscles, and a small incision made delicately into the thorax, to let out the confined air or blood.

Fourthly, If it be a gunshot wound, it will happen more frequently in that than in almost any other, that the wound of the lungs will heal very easily; for though there be at the first a bleeding from the wound, and an emphysematous tumor, a bloody foam at the mouth, a rattling breath, and apparent danger of suffocation; yet these very alarming appearances soon change. For in a gunshot wound there is, from the bluntness of the ball, a sort of laceration, attended with an immediate swelling of the wound in the lungs; there is an effusion of blood, or an ecchymosis all round that wound; the wound of the lung swells and closes; the lung is capable in some degree of inflation; the rising of the lung keeps the wound of the thorax and the internal wound of the lungs so in contact, that they soon adhere. This, therefore, is a business which we should not meddle with nor interrupt. If emphysema extend rapidly from both the bullet-holes, then we may find it requisite to dilate them; or if there be broken ribs, we may choose to get the splinters away: but if there be but a simple wound, no broken rib, no emphysema, little difficulty of breathing, and little spitting of blood, we should simply lay a piece of scraped lint upon each wound, put a gentle roller round the body, bleed the patient, and lay him quiet; for it has happened, that a man thus shot through the lungs, from being apparently in the most imminent danger, has been restored in a fortnight to the most perfect health.

IV.—*Of extracting the Splinters of fractured Ribs, Pieces of Cloth, Balls, or other foreign Bodies.*

Our most immediate duty is, to relieve the oppression of the lungs, by getting out the air and the blood, and next to enlarge the wound, and take away the splinters of fractured bone.

If a ball have broken the rib, the pieces of the bone will be easily felt with the point of the finger; the incisions should, therefore, be made such as to admit the finger easily, and to set all the splinters free; the splinters of bone may be picked away with the points of the fingers, or loosened with dressing forceps; the fingers should be put in to feel the course of the ball, or the damage it may have done; and you should not, at the first dressing, believe your work entirely done; more splinters may be sticking even in the substance of the lungs, supporting the suppuration, and causing a very pungent pain, and (just as in a fractured scull) you should be continually upon the watch to observe whether there yet remain any depressed bones injuring the lungs, and should endeavour in your daily dressings to feel them and to pick them out*.

Besides the splinters of ribs, there are pieces of the clothes to be accounted for, as also the ball when it does not pass through. If there be a piece of any of the clothes wanting, as of the waistcoat, and if there be a profuse suppuration and increasing pain, it proceeds most likely from that very piece of cloth having been carried in by the ball. In this case, we may put in the finger or a long probe to search for it; but it is by no means likely that it will be seen till the flux of matter wash it (after long danger and suffering) towards the wound. Yet we can in some degree imitate this operation of nature; for a mild injection of tepid milk and water, thrown through the thorax with a rapid stream, will at least sweep the thorax clean of grumous blood, and if practised frequently at the time of dressing, will (if assisted by a proper posture) bring any piece of cloth to present itself at the wound.

As for the ball itself, if it be lost in the thorax, it is irrecoverably lost; and no method that we can contrive will enable us either to find or to extract it. The matter cannot raise it towards the wound; it will fall downwards upon the diaphragm, and either settle itself, forming a sac there, or cause a suppuration; and should an empyema be formed, the incision which lets the matter out will probably also allow the ball to drop.

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* The introducing the point of the little finger, or of the fore finger, according to the size of the wound, does not interfere in any degree with our intention of closing the wound with a compress; for the finger should always be introduced gently, and this way of probing should never be repeated, unless when we are sensible of there being many splinters of bone.

V.—*Of supporting the Patient under the profuse Suppurations.*

The dangers of profuse suppuration are next to be apprehended; for it very frequently happens, that after a wound, and incisions like these, not only the dressings, but the very bed are drenched with matter, which, together with fever, cough, and violent pain, soon exhaust the patient. The first danger of suffocation is now over; the bloody expectoration has ceased; the strength is reduced to the very lowest ebb, more, it should seem, by our bleedings than by the wound; and we are bound by every motive to support the patient through what remains of the cure. Now, as the cough is not to be appeased by bleeding, we give large opiates to quiet it and to procure sleep; we give bark to keep up the suppuration kindly, and to make the wound heal; and we try to support the patient's strength by foods easy of digestion, and especially by soups, jellies, and a diet of milk.

If it should unfortunately happen, that the wound closes while all is not sound within, the formation of matter will be foretold by shiverings; the actual formation of it will be proved (as in any other abscess) by the cessation of fever, and abatement of the pain; and, when it is fully formed, it will be felt by a weight upon the diaphragm, and anxious and difficult breathing; and these signs will increase with the quantity of the matter, till at last the matter can be felt by the patient himself, dashing within as he moves. The surgeon can discover it by striking gently with his hand, and then, also, the patient will distinctly perceive, that he cannot sleep but on the affected side. When all these signs appear, the operation of cutting the side should be boldly done; it will give a temporary relief, delightful to the patient, after that kind of anxiety and suffering which is the most distressing of all to bear. Sometimes, no doubt, in this case we can accomplish a cure, but too often the patient, exhausted with the evening hectic and profuse flow of matter, soon dies;—he wastes away as in a consumption, and a few weeks close the scene.

Thus have I considered the several points of practice, showing you how to prevent suffocation, and to stop the bleedings in the lungs by profuse bleeding from the arm; how to get out extravasated blood, which lies oppressing the lungs, by enlarging the old incisions, or making new ones, and introducing a tube; and how, by tying the intercostal artery, to stop that source of blood; how to dispel the air of the general emphysema by slighter punctures, and when to make freer incisions in order to relieve the lungs. I have taught you how to pick away fractured bones; get out pieces of cloth; how to distinguish suppuration, and to perform the operation of emphyema, and how to support your patient under the vast discharge.

But I have been accustomed to add to this kind of general lesson a particular representation, as of an individual patient lying wounded, suffering the agonies, and struggling through the dangers of his wound, and happily in the present instance this manner of summing up the whole subject makes a very short and simple tale, not uninstructive.

Suppose, then, that you are brought to a man, who, being shot through the breast, is struggling for breath, and likely to die,—you know that the great danger is from blood thrown into the cells of the lungs—you see him in danger of this suffocation; you know it by his high breathing, and by the bloody foam which issues continually from his mouth; you know that the only chance of restraining the blood is by bleeding in the arm, and you bleed him freely upon the spot. Then, in the course of a few hours, the emphysema appears, which blows up the wound, extending along the breast, and increasing in size with a rapidity which astonishes and alarms the patient; you then scarify, or rather puncture the wound, and press out the air; but if the lungs become every moment more and more oppressed, you dilate the wound, so as to lay the chest in a manner open, leaving so free an exit for the air that the emphysema cannot form again, nor the lung be again oppressed. This free incision admits your finger; you feel for splinters of bone and pick them away; if the intercostal artery bleed, you secure it; if there be blood filling the thorax, which has come, perhaps, from the lungs, you get it out by changing the posture of the patient, or by the help of a tube, and then you lay a piece of oiled lint within the lips of the wound; apply a fomentation cloth over all, and so compose your patient to rest. At the next time of visiting, you find him again labouring in his breathing; he has had a pungent pain in his breast, which indicates some splinter of bone still pricking the pleura or lungs, and so at every dressing you let out blood, and when warned by pain, you always feel with your finger for splinters of bone. On the first day pure blood is discharged, and it runs freely: on the second day, still there is emptied from the thorax perhaps a pound of warm blood, mixed with clots: on the third day the blood is serous; and on the fourth, fifth, and sixth days, the bloody tinge disappears; pure serum succeeds to it, and pus again succeeds to the serum, till there is established at last a regular purulent discharge.

From the fifth day the patient grows easier; from the fifth to the tenth day, the bloody expectoration gradually decreases, till at last it ceases altogether; from the tenth to the twentieth day, the discharge from the breast decreases slowly, ceases at last, and allows the wound to close. But many interruptions will often cross you; the suppuration often flows in a continued stream, and wastes the patient; the fever often rises unexpectedly, with difficult breathing, oppressed lungs, and a profuse discharge. Sometimes you will find this accounted for by the irregularities of the patient; but if such symptoms return from time to time, or if there be a profuse discharge, without any obvious cause, you must renew your search for foreign bodies with all possible diligence: you see that the ball has gone fairly through; you think that the splinters of ribs which you have drawn away, fully account for the size of the hole which you feel; still, perhaps, you may be fortunate enough to discover one remaining splinter, which, however small, may have been the cause of all this distress, or by washing out the thorax with milk and water, from time to time (which you need not fear to do, when you know it to be full of grumous blood, or acrid pus), you may get away a piece, perhaps, of the waistcoat, upon which the wound will quickly heal. Thus, by care and prudence, and a continual attention to the symptoms, and to the wound, you will have the happiness of bringing your patient safe through all his dangers and sufferings; thus the ways of nature and good sense are so plain and easy, that nothing but a strange desire of wandering into whimsical and artificial practices can carry one aside from so direct a line.

But that you may have warnings as well as examples (and warnings are often of greater value than the best examples), I shall next present you, not with this fictitious representation of an easy cure, but the real history of a case which I boldly hold up to you as an instance of the very worst practice. I say boldly, because I am venturing to criticise the practice of one of the first surgeons in France,—a practice acknowledged by the Academy of Surgery, and so, by implication, approved by all the surgeons of France. I do not single out this case through mere wantonness, but because I think it really dangerous;—and when I shall have compared the bad practice, or what I think the bad practice, with the good, your judgment will be settled in one important point, so that you shall not need to pin your faith upon the authority of any author, or number of authors. You will then see clearly, and may choose whether you will abandon yourself to what I will call a presumptuous interference, or rather hold to the simple ways of nature;—whether you will keep the wound open by main force of setons or tents, or allow it to heal, if it will heal, expecting it to continue open naturally, if there should be any cause why it should not heal; for although the wound should close upon some piece of cloth or splinter of bone, such foreign body will produce matter, the matter will oppress the lungs, the oppression will require the operation for empyema; and that opening will allow at once the matter, and the piece of cloth, to escape.

An officer was brought to Mr. Guerin wounded by a ball, which had broken the fifth rib twice, entering before and coming out behind. Upon putting his fingers into each of the wounds, Mr. Guerin felt many splinters of bone. He dilated both with free incisions, and took away many splinters of bone. The patient coughed up much blood, his extremities were cold, his pulse suppressed; and there was such fear of suffocation, that Mr. Guerin could hardly be blamed for having ordered three bleedings during the night; bleedings were repeated the next day, and the cough and bloody expectoration being abated by the fourth day, it was plain that the patient was saved for the time, and that he had a chance of life. But here is the singularity of the management of the case; Mr. Guerin, after dilating the wounds, introduced a seton, which, of course, went as fairly across the breast as a bow-string crosses a bow, and this seton he continued to draw with a perseverance which is truly wonderful, from the first day to the thirty-eighth day of the wound; during all which time the patient's sufferings were dreadful. "From the fifth to the fifteenth day," says Mr. Guerin, "I drew the cord regularly; for fifteen days the symptoms were not diminished, and in these fifteen days I was obliged to bleed no less than twenty-six times." From the fifteenth to the twentieth, his patient was a little relieved; from the twentieth he grew worse, on account of a sudden movement of the army, being hurried onward to the city of Ghent; from the twentieth to the thirtieth day he grew greatly worse; by the thirtieth day Mr. Guerin had completed the number of twenty-nine bleedings, having bled his patient, by computation, every day, with the intermission of one day only. On the thirtieth day the attendant surgeon found himself obliged to bleed once more; and the symptoms growing much worse, consultations were called, and about the thirty-second day the seton was removed; on the thirty-third day the patient complained of a pricking pain, and they were sure something must be wrong; they could not feel the splinter of bone, but resolved, after mature deliberation, to cut up the side; and accordingly, an incision being made, which joined the two wounds, and was seven inches long, and the whole thorax being now laid open, they saw betwixt two of the ribs the course of the ball along the lungs, and the groove which it had made in them. They found a piece of bone sticking in the substance of the lungs, and having picked it out, this dreadful wound healed kindly, and the patient was saved.

From this case several reflections will arise; and you are already, I hope, so far surgeons, as to perceive that some steps of Mr. Guerin were bold and good, and, what is still more, were very successful; but that the main stroke of his surgery here, viz. the seton, was very wrong.

You will notice, also, in this case, First, How freely you ought to dilate every wound, more freely if there be fractured bones, and that all the splinters cannot be removed at once. Secondly, You will remark how useful the five bleedings in twenty-four hours were, towards saving this patient from suffocation; they were, indeed, the immediate means of preserving his life. Thirdly, You will find in this case a strong proof of what I affirmed, that (after all that has been said on this subject) there is no great danger in exposing any cavity to the air. Fourthly, You must remark, that where there is any very pressing danger, you ought to venture every thing, and that the bold incision of Mr. Guerin, which laid the thorax so freely open, did save his patient's life.

But on the other side of the account stands every thing that relates to this foolish seton; for, had Mr. Guerin been asked what good it was to do, it would have been difficult for him to have invented even a plausible apology for a practice, which, if it was not doing good, could not fail to do harm. Was this seton necessary for keeping the wound open? No, surely; for the wound could not have closed while it was irritated and kept in suppuration by splinters of bone, and a piece of cloth within the breast. Was it to draw the piece of cloth out? Surely, in the course of twenty days, a piece of cloth would have had some chance, at least, of being floated towards the wound, either by the natural flux of the matter, or by the help of a mild injection. Was it useful in suppurating the discharge? This would have been a sore question for Mr. Guerin; for it supported the suppuration only by inflaming the chest; and where inflammation of the chest, or high cough, or bloody expectoration, or a profuse discharge, were the chief dangers, a great seton could hardly be a comfortable inmate in the breast. I think one might very boldly promise to produce bloody expectoration and terrible cough, profuse suppurations and oppression, to any degree, by drawing such a cord across a sound thorax.

And it would be a sorer question still to ask, why did this gentleman never feel this pricking piece of bone till the thirty-eighth day; did it strike or dart into his lungs only on that particular day? I fear the reason of his not feeling it before is but too plain; the pain of drawing this harsh seton across the chest was such, that it deadened every lesser pain, and he could not feel the trifling pricking of a bone till his greater sufferings from the cord were allayed.

In short, Mr. Guerin passes a great strap of coarse linen across the cavity of the chest, and when it causes high inflammation, he thinks to subdue it by bleeding;—when Mr. Guerin continued for thirty days drawing a coarse seton through the breast every morning, and bleeding for the cough every night, what did he do, but raise inflammation with his left hand, to show how well he could subdue it with the right? With this warning, which I am sure you will understand in its true meaning, I shall conclude my observations upon wounds of the chest. But in leaving this subject, I cannot refrain from representing to you, how close the connexion is between good practice, and the knowledge of parts. To an ignorant man all is wonderful—to a well instructed man every thing is plain and easy; nothing passing within the patient, but what he calculates, foresees, prevents, knowing both the dangers, and the safety of the case. If the patient spits blood, he fears a wound of the lungs;—if there be an emphysema, he is sure of it;—if his patient be oppressed, he fears lest there be blood within the chest; and when he puts in his finger, he is sure of it, and relieves it;—if there be sharp pains, he thinks some pieces of bone are sticking in the side, and by searching for these also he gives relief;—if there be a violent cough, he apprehends inflammation;—if cough continue, with rising pain, he is sure that inflammation is begun;—if, with cough and pain increasing, the patient is daily more oppressed, he is sure the inflammation is then running dangerously high, and that his bleedings cannot keep it down;—if the patient be attacked with shiverings, he foresees matter;—if evening hectic come on, his suspicions are confirmed;—if the breathing grows daily more oppressed, he is sure of matter;—when the patient rests only on the left side, he is sure that the left side is full of pus; and having traced by symptoms only up to this stage, he strikes gently upon the thorax, and hears the matter dashing within;—and thus, through all the stages of this particular wound, the man of real knowledge sees clearly every thing that is going on within.

You would observe, at our last meeting, that I had begun to represent to you the absurdity of passing setons across the thorax. You will, perhaps, remember my late promise of explaining this matter more fully; and I would not disappoint you of any explanation, that might be either interesting or amusing to you; but, more especially, if such explanation concerned any great question, or could give you more determined notions, and a freer reliance upon your own judgment, in the affairs of practice; and I am persuaded, that this will really be the effect of laying before you a short history of setons and tents.

Formerly, in speaking of setons, I observed, that for medicines to be introduced upon setons, one could conceive many which might be hurtful, but none that could be useful; and, as for promoting the pus and shaking the bones, they would surely promote pus, just as splinters or balls would do; and they would shake many bones which should not have been loosened. Yet these are the best reasons that the French surgeons have been able to assign; and these have been assigned only, because they had still a hankering after a practice, which had been handed down to them by their fathers, but which they felt needed this kind of support.

When we come to search into this business, we find the history of it to be plainly this: that as Guy de Chauliac, Parée, and all the older surgeons, did not know how to scarify gunshot wounds, they found these same setons useful in bringing the eschar sooner away, and in preserving an open wound; and as they believed the wounds to be poisoned, they took the opportunity of conducting, by these setons, whatever acrid medicines might, according to the prevailing doctrines of that time, have any chance of correcting the poison. This, as far as it regards the old surgeons, is a full and true account of the whole matter, and is in no shape deserving of greater notice. But the doings of the modern surgeons, especially of the French, deserve some farther attention.

It is curious to see them attempting to vindicate by reason, a practice founded on such prejudices as these;—it is very surprising to observe the cruelty and perseverance with which they used to draw these cords through the wounded limbs; and when the roughness of such a cord, or the acrimony of the drugs conveyed by it, produced a large suppuration (however painful), they were delighted with such proofs of their success.

We find the French surgeons passing their setons across the thickest parts of the limbs,—running them up along the whole length of the forearm, and often, at the same time, passing them through the wrist joint,—loading them withal with acrid medicines;—no wonder then, that profuse suppurations and dreadful swellings came on;—but still they continued these cruelties, till the wound healed almost in spite of the pain, or till the coming on of very dreadful pain, great suppurations, and sometimes of convulsions, forced them to desist from this piece of surgery, and to draw out their setons, or sometimes to cut off the limb.

The French especially, artificial in their practice, have been addicted to this use of setons; and have, from step to step, become so familiar with them, that they have not confined the use of them merely to flesh wounds, but have passed them, as I lately explained to you, quite across the thorax,—across the belly,—and through the great joints, as the knee;—and, in wounds of the head, have supplied their place with long and slender tents.

When we want to fill up the sac of a hydrocele, or indeed to fill up the sac of any other tumor, what do we contrive, but either to lay it open with a large incision, or to run a seton through it?—to fill it with some acrid injection, or to cram it with a large tent? While the animal machine continues the same, the same stimuli will produce the same effects, and a seton, injection, or long tent, if they produce pain and inflammation in the scrotum, will not be easy in the chest; and unless we can use them in the chest, with the same intentions for which we use them in the hydrocele, unless it were our design to inflame the chest, and to cause an adhesion of all the parts, we cannot use them with any consistency or good sense.

This simple reasoning against setons is so conclusive, as to be a perfect refutation of the arguments used in their support; and, as for the matter of fact and experience, I have lately, in criticising the case given by Mr. Guerin, given you a pretty specimen of their practice, such as will set your conscience quite at ease, although you should be careless enough to omit the seton;—and I selected this case, not because it was the most foolish of many foolish doings of this kind;—there are many pieces of surgery recorded as wonderful as this:—but because it stands very prominent among the College Memoirs, and is made an authority on this point.

To say that such patients recovered by their setons, is, in my opinion, no more than to say, they recovered in spite of their setons. It is like what happened to a surgeon, who was dabbling in the thorax with a piece of caustic, which fell directly into the cavity of the chest, where it caused very large suppurations, and yet the patient was saved.—The patient recovered in spite of the caustic, just as Mr. Guerin's patient, and many other poor unhappy souls, have lived in spite of the setons. One would think, that people took a pleasure in passing setons across the eyeball, the chest, the knee-joint, &c.

merely to make fools stare, when the business might be as effectually done with an abscess lancet [*].

While I am thus reprobating the use of setons, surely that of the tents should not escape.—I know of no occasion in all surgery, in which tents can be useful, except in the single one of a narrow opening, which we desire to dilate, in order to get at the bottom of the wound; and where either, on account of some great artery, or the fearful temper of our patient, we dare not use the knife;—there a sponge-tent will force open the wound. A tent for keeping an old ulcer open is a downright absurdity, since such an ulcer will not close; but, to fill a fresh wound with hard round tents, is just as bad surgery, and as unnatural, as the passing of a seton across the wound.

The tents also of the French surgeons were often as carelessly managed, as they were imprudently used:—Very frequently, tents used in wounds of the belly were lost,—occasioned dangerous suppurations, and were in the end discharged with great pain and danger, at the distance of many months, or even years;—and not unfrequently, tents, drawn in by the backsucking of the lungs, have got into the thorax, lain there unsuspected, have occasioned long suppurations and even death [†]. Nay, still more, tents, which had been used in dressing wounds of the thorax, have made their way into the substance of the lungs, and so been coughed up. Hildanus tells of a man *, who, having been wounded in the breast with a sword, had been long dressed with tents, had escaped from hæmorrhages, difficult breathing, and the other dangers, and his wound at last healed up; but still he continued spitting pus, till one day, three months after the wounds had closed, he coughed up two tents, which had been used without threads to them.

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[*] If any one should wish to see the opinions of moderate authors, let him turn up the fifth volume of the System of Surgery, written by Mr. Benjamin Bell, where "Tents are employed, prepared of dried sponge, gentian root, and other articles; which, by swelling with the moisture of the sores," &c. &c.

[†] Vid. Ravaton, p. 221.

And Tulpius † tells of a Danish nobleman wounded in the German wars, who, after six months of pain and danger, coughed up two tents, with which they had dressed carelessly a wound in his chest;—and Pigrai, a pupil of Paræus, tells of a soldier, who, three or four months after his apparent cure from a wound of the breast, spit up a large piece of his rib, of considerable thickness, and, if my notes are correct, of no less than three inches long.

But if there was also knavery, in this way of using tents, that suspicion ruins at once all authority of the older surgeons; and La Motte declares roundly, that there was almost as much dishonesty as ignorance in this practice: "For I have observed," says La Motte, "one of your old master surgeons, in place of curing a wound of the belly in a few days, perform long incisions, cram it with tents, and confine his patients for six months, making a pretty hundred crowns, and much reputation to himself, out of a very simple matter:" so that ignorance and folly begot this practice; and when it was grown up to strength, knavery leagued with folly, and profited as the occasion served.

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* Observatio xiv.

† Observ. xv.

One thing more I must say concerning this old piece of surgery, that they were not nice about the materials of which their setons or tents were made: for a seton they used in general a piece of good stout tape or garter; they often took a long strip of linen, and named it a syndon; and as for their tents, they made them out of any thing that was large enough, strong enough, and hard enough; and La Motte, who had been often witness to these operations, avers, that they would very willingly have taken the help of a hammer to fasten them in, if they could but have done such a thing secretly or without shame; and here also they were quite delighted with seeing prodigious quantities of matter spouting out when they drew their spigot away.

Having settled this point, and confirmed you, I hope, in your abhorrence of any thing in practice so harsh and unlike the simple ways of nature, I will return to my subject of wounds of the breast; for as yet I have described merely the wounds of the lungs. I must also show you what are to be the consequences of wounds in the heart, or in the diaphragm, or on the outside of the chest.

Wounds in the left side of the breast are more dangerous than wounds in the right, on account of the heart's being there; and a wound through the left side of the breast, followed by faintings, difficult breathing, coldness of the extremities, suppression of the pulse, with great anxieties and deadly fear, are very certain signs that the man is wounded in the heart, and is about to die; and there is sufficient time for these signs to appear, for it is not always at the moment that the patient dies. One man being wounded with a sword, the point of it cut the coronary artery, which threw out its blood so slowly that it was two hours before the pericardium was filled with blood; and then, after great anxiety, the patient died. In another soldier, the apex of the heart was cut with the point of a very long and slender sword; and this soldier lived twelve hours, during which time, as appeared after his death, the heart had, at every stroke, been losing a small quantity of blood, till it had, in twelve hours, entirely filled the chest, and then the patient was suffocated and died.

But indeed, there is so little to be done in such a case, and the signs and the consequences of such a wound are so clear, that it were a waste of time to speak longer of wounds of the heart. Wounds of the diaphragm are also out of reach, and all that you can desire is to know what sort of accidents have happened to the diaphragm; and whether, after a wound of that important muscle, the patient will live or die. Though wounds of the diaphragm are not material in themselves, yet the diaphragm can hardly be touched, but in mortal wounds, i. e. in wounds touching both cavities, viz. of the thorax and of the abdomen, where most frequently the stomach, lungs, pericardium, or heart, are either wounded or are soon inflamed, and so drawn into disease. But there are some very curious cases, where the patient recovered from the present wound, and died not till some months or years after, by what I may call a thoracic hernia, the bowels passing upwards through the diaphragm into the breast.

Parée describes his dissection of a mason's boy, who being wounded in the breast, died on the third day; and upon opening the body, at first sight, he thought he observed a phenomenon which he could not easily believe; he thought the stomach wanting; he went onwards searching with particular care, until at last he found the stomach, not in the belly, but in the thorax, inflated with air; and he found that it had passed upwards, by the wound in the centre of the diaphragm, through a hole no bigger than to admit the thumb.

But there follows in Paræus, a much more singular case, and a very interesting one: a M. d'Allon, in the suite of the M. de Biren, grand master of the artillery of France, was wounded before the city of Rochelle, by a ball, which, entering at the lower end of the sternum, passed out again betwixt the fifth and sixth ribs. This wound was, you perceive, of the most dangerous nature; for it passed close over the stomach, which, had it been full, could not have escaped. The ball could not fail to wound the diaphragm,—it must also have passed through the lungs, and yet he was cured of his wound, but with an infirmity remaining, which could not be accounted for, till after his death, which happened in about nine months. He was to all appearance cured of his wound, and apparently out of all danger from any consequences of it; but ever after it, he had a weakness of the stomach, with frequent colics, and never durst make a hearty meal for fear of an attack. In the eighth month after his wound, he had a dreadful attack of this habitual colic, of which, notwithstanding every exertion, he died; and when his body was opened by the celebrated Guillmeau, there was found in the cavity of the thorax, a great turn of the intestine colon, much distended with wind in the proper condition of a hernia, and much strangulated, you may suppose, since it occasioned the patient's death.

Indeed, the hole in the diaphragm was so small that it scarcely permitted the point of the little finger to pass.

Wounds of the sternum should not be passed over in absolute silence, since these also may come under your care. I have formerly taught you, that when wounds and fractures of the sternum cause inflammation, and are followed by a collection of pus, there is formed a cavity under the sternum, which did not naturally exist; and however much the operation of trepanning, in this case, may be questioned in theory, the fact is, that you are sometimes forced to trepan; and for this there needs no better authority than that which we have from Galen, in his seventh book (of Dissections).

A servant of Marilus who had received a blow upon the breast bone neglected it at first; but there appeared, in four months after, a collection of matter upon the sternum, which his surgeon for the time opened and healed; but it soon inflamed, again proceeded to abscess, was again opened,—but it not healing, a great consultation was called (and Galen, among others): the breast bone was entirely rotten, the beating of the heart was seen on the left side of the diseased sternum, which frightened the physicians from undertaking his cure; but Galen was contented to take this upon himself: he adventured to cut the whole of the corrupted breast bone away; the bone adhering to the point of the heart-case or pericardium, that also was of course cut, and the heart exposed quite bare. They despaired of curing such a wound, and yet the patient was in the end perfectly restored. Here, then, we have upon that authority which has been always respected, a case exceeding, in the miraculous, all that has ever been recorded by the patient Vander Wiel, or gathered by Shenkius, or any German commentator among them. A man with a slow suppuration, confined matter, a carious sternum, and the heart absolutely exposed and bare.

The sternum may be thus fairly undermined with matter, so that where there is truly no natural cavity, a very deep one may be formed; of which we have a curious example recorded by La Motte, of a soldier, who, being wounded at the middle of the sternum with the point of a sword, felt no pain nor difficulty of breathing for some time, as if it had not reached the cavity of the chest. La Motte bled the man, and dressed his wound very simply; but at last the inflammation and oppression did come on; and one day in lifting the dressing, a large glassful of good pus spouted out, and then probing, he found that his probe went down very deep into the breast; but the matter came gradually in less and less quantities, till at last it ceased, and the wound closed.

You perceive that I have carefully gone through all the possible wounds of the breast; for I have given you lessons upon wounds of the lungs, wounds of the heart, wounds of the diaphragm, and wounds of the sternum; but there is one thing I am much concerned in observing to you, for it will regulate the prognostic that you are to make, and will also be a rule of some importance to you in the cure itself: it is that, in the first place, you are never to pronounce any wound mortal unless it be plainly a wound of the heart; for the recoveries which men make after the most desperate wounds of the lungs are truly surprising; and, next, you must be careful to distinguish wounds of the pectoral muscle, shoulder, or scapula, from wounds of the breast; for, were you not warned of this singularity, you would be inclined to believe that a wound had passed directly across the breast, when in fact the ball, or weapon, had only turned round the breast, and done no harm.

I shall now, in conclusion of this subject, reduce all that is important into the form of aphorisms or rules, showing the several degrees of danger, and the several ways of giving relief. And there is no subject on which I more willingly bestow this degree of labour; for this business of wounds of the breast is important; and it might, if I should leave it without saying more, appear somewhat confused.

1st. If the patient lies oppressed, tossing, insensible,—his face ghastly, and his extremities cold,—his condition is very doubtful; it looks much like a wound of some vessel, near the root of the lungs; and if so, he is surely gone.

2dly. If the oppression come on more slowly, the pulse only hurried and fluttering, and the extremities not so cold, there is reason to hope that his wound is merely in the edges of the lungs; and, as it is at a distance from the great veins and arteries, he may escape.

3dly. If spitting of blood, and the emphysema, or windy tumor come on, unquestionably he is wounded in the lungs; but that wound is not always fatal:—If either the blood do not flow in upon the lungs in great quantity, or if, by our profuse bleedings, that bloody exudation into the lungs can be restrained, then he may be saved.

4thly. If, when there is much oppression, we put our finger into the wound, let some blood out, and so give relief, we are sure that the suffocation proceeds from blood extravasated in the thorax; and that kind of suffocation we know to be less dangerous by far than that proceeding from blood poured into the proper cavity or cells of the lungs, i. e. into the air-cells, into which we draw the breath, and which, while they should be filled with air, are choked with blood.

5thly. If a bullet passes fairly through and through, the patient is safer: he is in great danger, if it stops, whether within the thorax, or in the lungs; for when it passes through, as soon as we have saved him, by bleedings, from the first dangers, he is saved:—but while it remains within the chest, he is exposed to tedious suppurations, incurable sores, hectic, wasting and death; and nothing so wearies the surgeon, or depresses the patient's hopes, as an unceasing flow of matter, and a fistulous sore; nor can any thing be more distressing to the surgeon than the seeing a patient slipping through his hands (to use so vulgar a phrase), more especially if, during a lingering distress, he has thought it necessary to support the friends with hopes and promises; for then it falls peculiarly on all concerned; on the surgeon, who has suggested, or allowed such hopes, as well as on those who have permitted themselves to be thus deceived.

I shall next, after what is commonly called the prognosis, explain to you in another set of aphorisms, how you should conduct the cure.

First, I think you will not easily forget, that sword or bayonet wounds often need no dilatations; and that the secret dressing, as it was called, or sucking the wounds, or in plain terms, the cure, by adhesion, had been, in such cases, attended with wonderful success.

Secondly, You know that gunshot wounds require dilatation more particularly, from the peculiar nature of the wound; and that such incisions must be particularly large, when you are sensible, that there are many splinters of the ribs to be extracted; that there are pieces of cloth driven in;—or that there is much blood lying upon the diaphragm and lungs.

Thirdly, You will remember, that the first and great danger is that of suffocation, from blood poured inwards to the trachea, and into the cells of the lungs; that it is your duty to keep the patient low, and to drain his system so thoroughly of blood, that none shall pass towards the lungs to suffocate him; and that there may not be blood enough in the system to serve as fuel for that inflammation, which, sooner or later, must come on, the excess of which is thus provided against, without any particular rule.

Fourthly, The next great danger is of blood within the thorax, oppressing the lungs. It may perhaps be gotten out, by laying the head and shoulders out of the bed, making the patient heave and strain for its discharge; but these are rather the attempts of less regular or skilful surgeons, while a man of real skill boldly puts his finger into the wound, or introduces a tube, or makes a new wound, if the first be too high in the thorax; and he makes his wound so free as to have it in his power to tie the intercostal artery easily, if it be from it that this blood has come.

Fifthly, The emphysema is the symptom the most alarming, and yet the least dangerous of all; it advances so fast, covers the chest so quickly, blows up, at last, the neck and face, and is, withal, so strange a symptom, that the patient is terrified, but the surgeon cannot be alarmed;—he knows the symptom, and how trifling it is;—scarifies the wound, presses out the air, and makes the passage for the air so free, that it cannot collect again.

Sixthly, The surgeon, never free from anxiety during the cure, watches the breathing, the cough, the fever, and the condition of the wound; keeps an eye upon all these points at once; and when there is a pricking in the side, when there is any aggravation of the cough, when there is an increase of the discharge, instantly his fears are excited for his patient's safety; he probes the wound,—feels it with his finger,—washes the thorax with an injection,—is at infinite pains to find any little piece of bone that may be touching the lungs,—and tries to hook out any piece of cloth with his probe, or to float it towards the wound, by a mild and warm injection.

Seventhly, Sensible, at every turn, how slight a matter will irritate the pleura and lungs, he will never allow himself to do so unnatural and cruel a thing, as to pass a great chord across the chest, which is thus easily irritated by the most trifling piece of bone, or rag of cloth; but merely lays a bit of oiled lint gently within the wound, with a large emollient poultice over all.

Eighthly, And he must learn to play the part of surgeon and physician at once; and very fit it is, that the man who is managing the wound should guide the system. Let the surgeon then lay aside all apprehensions, and all theory about fevers, and commotions of the system, to attend to the single duty of managing the patient's strength,—whom he must bleed, in the first instance, almost to death,—bleeding not according to his own prudence, but according to the exigencies of the case. He must repeat his bleedings, whenever bloody expectoration returns; whatever lengths that threatens to go, he still must go before it, and prevent suffocation, by draining the system of blood. He bleeds, then, in the first days, not according to his discretion, but according to the exigencies of the case, against his will, reckoning to pay dearly for the present bleedings in some future period of the cure; and when the time comes, in which the oppression is forgotten, and the danger of suffocation, and the bleedings from the lungs are over, he begins to support his patient's strength with opium and bark, and nourishing diet and milk; and then the ignorant friends begin to blame him for those very bleedings which really saved the patient's life; then only he feels within himself the value of all his former care of his patient; "he is so strong built up in honesty, that peevish words pass by him as the idle wind, which he regards not."

ON WOUNDS OF THE BELLY.

Every wound is a disease, and every disease is different according to the constitution of the parts affected, and according to the offices which the parts are destined to fulfil. In the abdomen, we find the principles which explain its diseases, very simple and plain: we find the chief cause of danger to be the tendency of the peritoneum to inflame; we find every wound apt to excite this inflammation, and every inflammation, however slight, apt to spread, to extend itself over all the viscera, and terminate in gangrene and death. Upon these grounds, we cannot but pronounce a wound of the belly to be a mortal wound.

There are a thousand occasions on which this delicacy of the peritoneum may be observed; the wound of the small sword, and the stab of the stiletto, explain to us how quickly the peritoneum and all its contained bowels inflame by the most minute wound, although it be almost too small to be visible on the outside, and scarcely within; for often upon dissection no intestines are seen to be wounded, and no fæces have escaped into the abdomen. In those who die after lithotomy, we find the cavity of the peritoneum universally inflamed; the operation of Cæsarian section is fatal, not from loss of blood, nor from being exposed to the air, for they also die in whom the womb bursts, and where the air is not allowed to enter; but merely from that inflammation which succeeds to wounds of the peritoneum, small as well as great, of which we have sometimes a melancholy proof in the operation of hernia, in which the stitching the wound according to the whimsical improvements of some modern surgeons, or where the mere tying of the sac, as in the practice of the old rupture doctors and castrators, often raised such inflammation as spread very quickly over the abdomen, and ended in gangrene.

The first principle, therefore, and the thing most to be spoken of in explaining wounds of the belly, is this tendency of the peritoneum to inflame; and the cause which immediately excites this inflammation must be still more noticed. For though this inflammation may no doubt come on from the slightest scratch in the peritoneum itself, yet, in general, it arises rather from the wound of some one of the viscera. If an intestine be wounded, it pours out its fæces into the abdomen; if the liver, spleen, or kidney be wounded, these pour out blood; if the bladder, then the urine filters into the cavity of the belly. The food, or fæces, or urine, or blood, are as foreign bodies lying in the cavity of the abdomen, which no activity of the absorbents can remove. They remain there as foreign bodies, which soon cause inflammation; there follows a knotting together, and great disorder of all the intestines, attended with intense vomiting, excruciating pains, hiccup, a quick, weak, and fluttering pulse, mortification of the bowels, and then a low delirium closes the scene.

Wounds of the head are deadly, from the oppression of the brain; and there delirium or coma are the deadly signs. Wounds of the breast are fatal, by the oppression of the lungs; and there difficult breathing, tossing, coughing of blood, coldness of the extremities, and a faltering pulse, are the mortal signs. Wounds of the abdomen are mortal, by the inflammation and gangrene; and the signs of danger are, swelling of the abdomen, intense pain, vomitings, costiveness, hiccup, faintings, then an interval of deceitful ease, which is merely a sign of internal gangrene, and of the near approach of death.

Thus you perceive that a lecture on wounds of the abdomen must be a lecture on inflammation of that cavity, and of the various ways in which it is produced. It is also but too plain, that here we are spectators merely, or with kinder thought of watching over our patients, and doing the little that art can do; but that in general we have no other privilege than that of pronouncing whether he is likely to live or die. This also must be remarked, that while we are laying down the general principles, we are ready to pronounce that every wound of the abdomen is mortal; but when we descend to the particular cases, we have such strange examples of unexpected cures, that we are ready to retract our first position, believing that hardly any wound is deadly; and the reason of this deception must also be observed. Having put it down as a prognostic, which is but too well confirmed, by much melancholy experience, that wounds of the belly are mortal, there is no reason why we should, in recording our cases, take any note of a man having died after such a wound; death, from such a wound, is a daily and expected occurrence, and therefore it is not marked; but, if we find that a man has escaped, are we not to record every such escape? Is it not our duty to set up and marshal in fair array all the possible wounds, to mark out which are possibly safe, and which are absolutely mortal; to distinguish the various accidents of all the various wounds; and to try whether by such observations we can lessen their dangers?

Thence it comes to pass, that, in one short sentence, we announce the general principles of such wounds,—in one short and general prognostic we declare them to be fatal; we thus bestow but a few moments on their general character, while we spend hours in marking their lesser varieties, and in recording all the accidents and chance cures, collecting evidence about hair-breadth escapes, till we almost lose sight of the general principle which proves such wounds to be mortal. This confusion must be peculiarly felt by a diligent student, who, the more he reads, the more he wonders, finds anuses at the groin, and miraculous recoveries in every book, and reads of cures, till he forgets that there are dangers.

In judging of wounds of the lower belly, much must be taken into account before we form our opinion. We are often likely to be deceived; we see the patient lying quiet and easy, while we know that he is on the very brink of danger; and there is often great confusion and alarm when the patient is absolutely safe; for balls sometimes turn so, that a shot shall pass through among all the bowels, without wounding one; though it must be acknowledged, that the belly is so full of parts essential to life, that there can hardly be a wound of the abdomen in which one or other of the bowels is not concerned.

Our patient feels little, in the moment of the wound, save that confusion, trembling, and alarm which is the immediate consequence of fear, but which is allayed by time and a slight opiate, or a cordial draught.

If stools come on soon after the wound, and if the belly continue regular and easy but for a few days, it is a comfortable assurance (or it is almost an assurance) that the bowels are unhurt.

If on the second, third, or fourth day, a swelling, pain, and burning fever come on, if soon after there come dreadful torments, then the belly is completely inflamed, and the danger very great; the bowels will mortify, and the patient being suddenly relieved from pain, will be easy for a few hours, and will sink, after this deceitful interval, into a low and muttering delirium, and die.

If this threatening inflammation be kept off by profuse bleeding, by low diet, and by absolute rest;

or if it be thus subdued after having begun, then the chief danger is over, and the patient is in some degree safe. Yet sometimes the belly is easy, and the bowels regular for some days, when most unexpectedly fæces appear at the outward wound; which accident throws us back into great consternation; it is a sign of great danger; for often, though the bowels are wounded, yet from their emptiness, or the closeness of the wound, or from vomiting, or by some other chance, the fæces are not at first discharged through the wound. And again, though the belly continuing regular and easy for many days is no doubt a proof that the intestines are not wounded, it is by no means a perfect security that they are not hurt; for the ball may have brushed through among them with such velocity that the intestines may be bruised like the external wounds, the hurt parts of the intestines may slough off, and the intestines opening from such a cause, on the sixth, eighth, or tenth, or fifteenth day, will pour out their fæces into the cavity of the abdomen. The signs of these two kinds of injury to the intestines are very plain; for, if there be a direct wound of the bowels, there will be an immediate interruption of stools, immediate swelling of the belly, vomiting, hiccup, and death: or, on the other hand, there may come, after many days of free passage in the belly, a sudden interruption of the stools, with as sudden a swelling and hardness of the belly, then vomiting, hiccup, and death; and then we find upon dissection, that this sudden death has been from a gangrene of the bowels, which had been bruised in the rapid passage of the ball, the eschar of that gangrene not breaking till the eighth or tenth day.

Since, then, this slough of the bruised intestines will fall out about the time of the inflaming of the wounds, we never can be without great anxieties about our patient's safety, till after the sloughing of the wounds is over: and even then our patient is only in some degree, but not entirely safe; for there is another danger still:

The two wounds, viz. the entrance and the exit of the ball, being gunshot wounds, continue dead and callous for five or six days; then the bruised parts recover their action,—inflame, swell, and throw off their putrid sloughs. It is but too plain, that this inflammation of the external wound may be communicated to the whole cavity of the abdomen, and the inflammation of the abdomen may be thus renewed. This, also, is to be guarded against; and, therefore, we do not relent in bleedings, low diet, perfect and absolute rest, till the fifteenth or twentieth day.

If, unhappily, the ball has not passed through, but remains somewhere within the abdomen, other fears and dangers await us, which bring to our remembrance the aphorism concerning wounds of the thorax, that "while the ball remains within the thorax, the patient, though saved from the first dangers, is exposed to tedious suppurations, incurable sores, hectic, wasting, and death; and nothing so wearies the surgeon, nor depresses the patient's hopes, as an unceasing flow of matter, and a fistulous sore."

Here, also, the patient is peculiarly exposed to wasting suppurations, and to still greater dangers. The ball, if it have entered near the navel, or upon the middle line of the belly, will stick in the lumbar vertebræ, and will cause paralysis of the bladder and lower extremities, soon followed by death. If it have passed obliquely through the abdomen, or to one side of the middle line, it will lodge in the thick flesh of the Iliac, or Psoas muscle; and the patient after having passed through the first dangers, feels little more than a weight and weariness of the loins; but when he raises himself to sit up in the bed, the weariness is converted into pain. Sometimes the ball makes a bed for itself, and lies harmless in the loins; sometimes also, if the shot has entered near the pubis, by passing over the thigh, and has gone obliquely upwards, there is a frequent draining of matter, and a small fistulous sore; but most frequently of all, the outward wound closes, the patient is never relieved from a dull and heavy pain, never recovers the free use of his limbs, nor is able to support his body erect, but wastes under a slow hectic fever; and when he dies, there is found a great abscess in the loins.

Sometimes a ball, passing obliquely, not from below upwards, but from above downwards, enters the belly, breaks some of the bones of the pelvis, passes out perhaps through the middle of the haunch bone;—and there a very free dilatation is required, both to make an open wound, and to take away the splinters of so large a bone, and to prevent matter forming within the pelvis, and inflaming the abdomen.

Sometimes a ball, entering over the thigh, and near Poupart's Ligament, or about the ring, seems to pass into the abdomen, while, in fact, it goes behind the peritoneum, courses along the bones, lodges about the Ala Ilii, or perhaps goes so high as the loins. There the inflammation is subdued by bleeding, and never reaches the abdominal cavity; or if it threaten to do so, it is easily restrained,—a fistulous sore ensues,—at times it gleets profusely,—then it stops, with swelling and pain, not without danger;—again it bursts out, and runs freely, and pieces of cloth, and fractured or spoiled bones are from time to time discharged,—the finger, or probe, are sometimes introduced in search of the ball;—sometimes we feel an indistinct rub, as in sounding for the stone,—then it disappears,—then we feel it again,—and again it disappears,—till at last, in a lucky hour, the ball presents itself at the groin, and is pulled away. In all this, there is an appearance of the ball's changing place, so strong, as to encourage us to try at last what posture will do; for turning often upon the belly has actually brought such balls towards the groin; which need not surprise us, when we see balls not lodged, as in this case, among a looser cellular substance, but in the solid flesh of the limbs, work downwards by posture, and their own weight.

Often, when balls go down into the pelvis, they are fatal by the wound being in the bladder, and the urine getting into the abdomen; or by causing a high and gangrenous inflammation; or by the thickness of the bones that are broken, producing long suppuration, and an incurable sore. But sometimes the first inflammation being subdued, such balls lodge about the bones; and we can neither conceive where they can be so effectually concealed, nor how they can lie there without danger or pain. Sometimes, however, the ball lies looser, falls down into the bottom of the pelvis, and produces tumor there; and once Mr. Boerdenave, after such a wound, feeling a fluctuation in the perineum, made a lithotomy like incision, and got out some pieces of shirt, much urine, much clotted blood, and the ball, so that his patient was perfectly cured.

Having spoken of this inflammation of the peritoneum, as the chief cause of danger, let me next explain to you, how this same inflammation is also (by causing an adhesion of the wounded bowel) the only means of safety; for if a wounded or diseased bowel were to continue but a few hours unattached to the abdomen, it must be fatal. If the liver be inflamed, it adheres to the peritoneum; their substances are so mixed, that they become as one, and then the pus, gathered within the substance of the liver, instead of being poured out into the abdomen, makes its way outwards, and so the abscess bursts, or is punctured, and heals. In dropsy of the ovarium, we should not dare to tap the patient, lest the intestines should be betwixt the integuments and this dropsical sac, but that we know, how the sac of the diseased ovarium unites itself, by inflammation, to the inner surface of the peritoneum, as soon as they touch each other. If a fœtus be conceived in the ovarium, or be by laceration thrown out of the womb, the woman, if she survive, is freed from her burden by the sac which encloses the child adhering to the inner surface of the abdomen, where abscess forms, and the fœtus is expelled piecemeal, bone after bone, till the whole is discharged. In hernia, an adhesion of this kind saves the life; for the intestine, which is hurt in the stricture of a hernia, is strangulated, inflames, mortifies, and bursts; and then it would go back into the belly, cast out its putrid fæces there, and so prove fatal, but that the gut always inflames before it mortifies: during that state of inflammation, it is hard driven into the ring;—there it is fixed, adheres, is straitened more and more, till the mortification is complete. But observe how this is effected: all that is below the stricture mortifies; all that is above it is sound; all that is in the very strait of the ring is highly inflamed, and has so adhered, that before the lower part mortifies, this part is firmly fixed in its place; and when the mortified part bursts out, the inflamed part keeps its place in the groin, adhering to the ring. It is thus that the preternatural anus is formed, and the surgeon, in sewing such an intestine to the ring, takes useless pains to fix what has already adhered; if there be a work of supererogation in surgery, as I believe there are but too many, surely this of sewing an intestine is one.

This it is which makes the chief difference, in point of danger, betwixt an ulcerated and a wounded intestine;—for in a wound there is, as we should suppose, no time for adhesion,—nothing to keep the parts in contact,—no cause by which the adhesion might be produced. But in an ulcer, there is a slow disease,—tedious inflammation,—adhesion first, and abscess and bursting afterwards; sometimes a fistula remains, discharging fæces, and sometimes there is a perfect cure. If a nut-shell, a large coin, a bone, or any dangerous thing be swallowed, it stops in the stomach, causing swelling and dreadful pain; at last, a hard firm tumor appears, and then it suppurates,—bursts, the bowel opens, the food is discharged at every meal, till the fistula gradually lessens, and heals at last. But where the stomach is cut with a broad wound of a sabre, the food too often pours out into the abdomen, and the patient dies. In the same way, if the piece of bone, or the coin, go down into the intestines, and stick in some narrower turn, causing an inflammation there; or if worms, nestling in the bowels, hurt them, the inflammation of the hurt intestine unites it to the peritoneum, abscess forms and bursts, the worms, or coin, or piece of bone, are discharged, the fistula heals, and all is safe. But if the same piece of intestine were wounded with a ball, much more if with a clean cut of a sabre, how could it fail to pour its fæces into the abdomen, or what could keep the wound of intestines opposite to the external wound, or cause them to adhere? Why, there is one cause, but little noticed, perhaps, and yet of considerable effect, which, though it cannot always prevent the discharge of fæces into the abdomen, often does.

I am well persuaded, that the intestines move less, in respect to their appropriated point of the abdomen, than their croakings in flatus, or their motion in our experiments upon opening animals, should lead us to suppose*. We see the bowels loose and floating, when we open a body; we see them hanging by the mesentery, and we call it a ligament for supporting the bowels; and we see the bowels turning over each other, in the cruel experiments which we make upon living creatures *. These circumstances make an impression which it is not easy to forget; and yet, when we talk of blood, or of fæces falling into the cavity of the abdomen, as if there were there some empty space, such as we see upon opening a dead body, I fear that we have a very poor notion of the abdomen, very unlike the truth.

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* When I speak of their motions, in our experiments upon animals, I mean to allow, for the sake of argument, more than can easily be proved: for I will venture to assure you, after all that has been said about peristaltic, vermicular, and antiperistaltic motions, that you may cut open twenty live cats, and never have the luck to see the least degree of motion in their intestines, nor any such thing.—Vid. Memoires de l'Academie des Sciences.

There is not, truly, any cavity in the human body, but all the hollow bowels are filled with their contents—all the cavities filled with their hollow bowels—and the whole is equally and fairly pressed. Thus, in the abdomen, all the viscera are moved by the diaphragm and the abdominal muscles, upwards and downwards, with an equable continual pressure, which has no interval; and one would be apt to add, the intestines have no repose, being kept thus in continual motion; but though the action of the diaphragm, and the reaction of the abdominal muscles,

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* It is only after having given the creatures the most acrid poison, that we can see such motions; we seldom see any thing like this in the natural condition of the bowels. We see nothing like it, when the bowels of a human subject are among our hands, as in wounds or in herniæ. We feel nothing like it, when, after rupture of the womb, we follow the child into the abdomen, with our hand, to extract it. I have seen a child born, wanting all the integuments of the abdomen, the peritoneum only covering the bowels, and the peritoneum as transparent as a piece of the finest oiled paper; and there I saw no motion, though I often looked with anxious attention, both while the child was asleep, and when it was struggling, being awake; and I have kept the preparation, to authenticate as much of the fact as a preparation can explain. I have looked, with the same degree of attention, to the bowels of a man, who, having thrown himself from a great height, had burst the abdomen entirely, so that all the bowels hung out. I have, indeed, not been guilty of cutting open the bellies of many cats or pigs, but I have a very poor opinion of the proofs which will arise from such experiments, from all that I have hitherto seen. That there is a motion in the intestines, I think it were very bold to deny; but that there is that kind and degree of motion which has commonly been described, I am very far from believing.

is alternate, the pressure is continual; the motion, which it produces, is like that which the bowels have when we move forwards in walking, having a motion with respect to space, but none with regard to each other, or to the part of the belly which covers them; the whole mass of the bowels is alternately pressed, to use a coarse illustration, as if betwixt two broad hands, which keep each turn of intestine in its right place, while the whole mass is regularly moved. When the bowels are forced down by the diaphragm, the abdominal muscles recede; when the bowels are pushed back again, it is the reaction of the abdominal muscles that forces them back, and follows them; there is never an instant of interruption of this pressure, never a moment in which the bowels do not press against the peritoneum; nor is there the smallest reason to doubt, that the same points in each are continually opposed. We see, that the intestines do not move, or, at least, do not need to move, in performing their functions; for, in hernia, where large turns of intestines are cut off by gangrene, the remaining part of the same intestine is close fixed to the groin, and yet the bowels are easy, and their functions regular. We find the bowels regular, when they lie out of the belly in hernia, as when a certain turn of the intestine lies in the scrotum or thigh, or in a hernia of the navel; and where yet they are so absolutely fixed, that the piece of intestine is marked by the straightness of the rings. We find a person, after a wound of the intestine, having free stools for many days; and what is it that prevents the fæces from escaping, but merely this regular and universal pressure? We find the same person, on the fourth or fifth day, with fæces coming from the wound! a proof, surely, that the wound of the intestine is still opposite, or nearly opposite, to the external wound. We find the same patient recovering without one ill sign! What better proof than this could we desire, that none of the fæces have exuded into the abdomen?

If, in a wound of the stomach, the food could get easily out by that wound, the stomach would unload itself that way,—there would be no vomiting, the patient must die: but so regular and continual is this pressure, that the instant a man is wounded in the stomach he vomits, he continues vomiting for many days, while not one particle escapes into the cavity of the abdomen. The outward wound is commonly opposite to that of the stomach, and by that passage some part of the food comes out; but when any accident removes the inward wound of the stomach from the outward wound, the abdominal muscles press upon the stomach, and follow it so closely, that if there be not a mere laceration extremely wide, this pressure closes the hole, keeps the food in, enables the patient to vomit, and not a particle, even of jellies or soups, is ever lost, or goes out into the cavity of the belly.

How, without this universal and continual pressure, could the viscera be supported? Could its ligaments, as we call them, support the weight of the liver—or what could support the weight of the stomach when filled? Could the mesentery or omentum support the intestines—or could its own ligaments, as we still name them, support the womb? How, without this uniform pressure, could these viscera fail to give way and burst? How could the circulation of the abdomen go on? How could the liver or spleen, so turgid as they are with blood, fail to burst? Or what possibly could support the loose veins and arteries of the abdomen, since many of them, e. g. the splenic vein, is two feet in length, is of the diameter of the thumb, and has no other than the common pellucid and delicate coats of the veins? How could the viscera of the abdomen bear shocks and falls if not supported by the universal pressure of surrounding parts? In short, the accident of hernia being forced out by any blow upon the belly, or by any sudden strain, explains to us how perfectly full the abdomen is, and how ill it is able to bear any pressure, even from its own muscles, without some point yielding, and some one of its bowels being thrown out. And the sickness and faintness which immediately follow the drawing off of the waters of a dropsy, explain to us what are the consequences of such pressure being even for a moment relaxed.

But, perhaps, one of the strongest proofs is this, that the principle must be acknowledged, in order to explain what happens daily in wounds; for, though in theory we should be inclined to make this distinction, that the hernia or abscess of the intestines will adhere and be safe, but that wounded intestines not having time to adhere, will become flaccid, as we see them do in dissections, and so falling away from the external wound, will pour out their fæces into the abdomen, and prove fatal; though we should settle this as a fair and good distinction in theory, we find that it will never answer in practice. Soldiers recover daily from the most desperate wounds; and the most likely reasons that we can assign for it are, the fulness of the abdomen, the universal, equable, and gentle pressure; and the active disposition of the peritoneum, ready to inflame with the slightest touch; the wounded intestine is, by the universal pressure, kept close to the external wound, and the peritoneum and the intestine are equally inclined to adhere; in a few hours that adhesion is begun which is to save the patient's life, and the lips of the wounded intestine are glued to the lips of the external wound. Thus is the side of the intestine united to the inner surface of the abdomen; and though the gut casts out its fæces while the wound is open, though it often casts them out more freely while the first inflammation lasts, yet the fæces resume their regular course whenever the wound is disposed to close; or if the fæces should not resume their natural course, we may force them onwards, by closing the wound with a plaster, thus healing the fistula, which otherwise might never close.

The two chief points of this doctrine are curiously proved by a case delivered by Mr. Littre, anno 1705; it is the case of a madman who stabbed himself with eighteen deep wounds, in the belly, and of these eighteen wounds, made with a long and sharp pointed knife, eight penetrated into the cavity of the abdomen. The fever, pain, swelling, and difficult breathing, with vomiting and purging, proved them to be dangerous wounds; vomiting of blood, and clots of blood discharged by stool, proved that the wounds touched the stomach and intestines; yet desperate as this case appeared, in two months the man was entirely restored. But here lies the important point; his madness came upon him again, and about eighteen months after he threw himself from a high window, and died upon the spot. Upon opening his body, it was found, first, that the liver had been wounded, and had adhered in its middle lobe to the inner surface of the peritoneum; secondly, the jejunum had been wounded, just below the stomach, with a cut half an inch in length, across the gut, and this intestine lying deep, was not pressed against the internal surface of the belly, but was kept in close contact with a contiguous turn of the same gut. The two turns of intestine adhered to each other; on the one intestine was the scar of the wound, while the other turn of intestine to which it had adhered was sound. Thirdly, the right side of the colon had been wounded with a cut of an inch in length; the scar which it left was half an inch long; the adhesion here was to the inner side face of the peritoneum, by eighteen or twenty long thread-like tags of cellular membrane or of peritoneum, issuing from the inner surface of one of the greatest scars in the belly.

Surely these things prove that the universal pressure within the abdomen is so uniform and constant, that not one only, but all the viscera of the abdomen may be deeply wounded, and yet no blood nor fæces be allowed to escape. They prove that this universal pressure keeps all the parts so in contact, that they have the fairest opportunity of adhering. The particular manner in which the wounded turn of the duodenum had adhered to the opposite sound turn of the same gut, proves, that towards which side soever a wounded intestine is pressed, it there finds the parts disposed, by a sort of contagion, to inflame and to adhere. And one thing appears to me very curious in this process of nature, that as soon as wounded parts adhere, then all the dangers of spreading inflammation cease; so that it is not by the stopping of the inflammation at the true point, that the wounded part adheres; but it is rather by the adhering of the wounded part that the inflammation is prevented from spreading wide over all the surfaces within the abdomen, just as the obliterating of an inflamed vein, by putting its sides together with a compress, stops the progress of the inflammation along that vein.

In short, if any man had made experiments like these, upon animals, with the hopes of proving such a doctrine as that which I have proposed, he would have been very vain of his success.

Our good old surgeon Wiseman has said with great simplicity, as a great many have said after him,—"Thus it frequently happeneth that a sword passeth through the body without wounding any considerable part." He means, that a rapier or ball often passes quite across the belly, in at the navel and out at the back, and that (without one bad sign) the patient recovers, and (as has very often happened) walks abroad in good health in eight days; which speedy cure has been supposed to imply a simple wound, in which all the bowels have escaped. But we see now *how* this is to be explained; for we know, that in a thrust across the abdomen, six turns of intestine may be wounded—each wound may adhere; adhesion, we know, is begun in a few hours, and is perfected in a few days; and when it is perfect, all danger of inflammation is over; and when the danger of inflammation is over, the patient may walk abroad; so that we may do just as old Wiseman did in this case here alluded to*, "Bleed him, and advise him to keep his bed and be quiet." In short, a man thus wounded, if he be kept low, has his chance of escaping by an adhesion of the internal wounds.

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* Page 98. The case of a man who was wounded across the belly, and well and abroad in seven days.

Thus you see I have made good that axiom which I laid down at the head of this discussion, too long, perhaps, but which I could not avoid, viz. "That this tendency of the peritoneum to inflame, which is the chief cause of danger, is also the only means of safety." And having laid down the principles upon which you are to calculate the dangers of each wound, it will be easy for you to understand the distinction of wounds; you will naturally apprehend, that this (like many other provisions of nature) too often fails; and that there will be danger of fæces getting out into the abdomen, just in proportion to the broadness of the wound, or according to the bowel that is struck. If the stomach be wounded, there is reason to fear lest that bag, which lies so deep, and sinks so much under the weight of the liver, when emptied of its contents, should fall away from the outward wound. If a small intestine be wounded, there is more reason to hope that the general pressure will keep it in close contact with the walls of the abdomen, so as to give it an adhesion to the wound. If the great gut be wounded, near either of the groins, our chance is mended still more, for the caput coli, and its sigmoid flexure, are so fixed down to the loins, as to secure us against many accidents. The wound of that gut will not forsake the wound of the abdomen; the fæces will not escape into the cavity of the belly; the intestine will not be so likely to double upon itself, and protrude, like a prolapsus ani, an accident which the floating intestines are peculiarly subject to, when they have been engaged in herniæ, and have gangrened, so as to have formed an anus at the groin. Lastly, by the close connexion of the bottom, especially of the caput coli, with the thick and fleshy parts of the loins, it easily heals. All this has been observed a hundred times, when this great gut has been engaged in herniæ, or when worms, cherry stones, bones, leaden bullets, or other dangerous things, have remained in it, so as to cause an abscess with discharge of fæces in the groin, or when the wounds of swords have penetrated into the gut.

But other conclusions may perhaps arise from the doctrine of universal pressure, which, once settled and acknowledged, would prove fatal to one of the most approved theories of the present day; for, if there be any one general doctrine in modern surgery universally received, and having a general influence on practice, it is this, that air being admitted into the cavities of shut sacs, causes an inflammation, which runs round the whole membrane; disorders all the parts contained in it, and almost always causes death, whether it be by suddenly hurting the vital parts, as when the inflammation is in the head, breast, or belly, or whether it be by hectic, and a slow fever in wounds of the less important parts, as of the bursæ, or joints. And yet if there be any one doctrine, which the common laws of philosophy seem to contradict, it is this; for how air should (according to the now vulgar phrase) "get access to the cavity of a shut sac," it is not easy to conceive. Whatever has become a general opinion must command respect; and, therefore, while I propose some doubts on this subject, I hope that they will be considered as doubts merely, not as refutations; for doubts concerning a general opinion will arise in a man's mind long before a perfect refutation can be accomplished. It seems to me, that there are here chiefly two points to be settled, First, Whether air really can be admitted thus into the cavity of the abdomen? Secondly, Whether, though air were freely admitted, it be capable of producing those dreadful effects which are ascribed to it?

If there be any truth in the doctrine which I am trying to establish, there can be but very little reason in the common theory of air being admitted among the bowels. Suppose a wound of an inch in length; suppose the bowels to have sunk, in some strange way, into the pelvis, for example, so as to have left a mere vacuum; what should happen with the flexible parietes of the abdomen? Should they stand rigid, while the air rushed into the cavity to fill it? No, surely. But, on the contrary, the walls of the abdomen would fall together, and the pressure of the outward air, far from making the air rush in by the outward wound, would at once lay the belly flat, and close the wound. But since the walls of the abdomen are not flaccid, nor the cavity empty, but the abdomen full, and the flat muscles which cover it acting strongly, the effect must be much more particular; for, the moment that the belly is wounded, the action of the muscles will force out part of the bowels; the continuance of that action is necessary to respiration; the respiration continues as regular after the wound as before; and the continual pressure of the abdominal muscles and the diaphragm against all the viscera of the abdomen prevents the access of air so effectually, that though you should hold such a wound open with your fingers, no air could pass into the abdomen, further than to that piece of gut which you first touch with your finger, when you thrust it into the abdomen. Nothing is absolutely exposed to the air, except that piece of intestine which is without the abdomen, or that which you see when you expose a small piece of the bowels, by holding aside the lips of the wound. The pressing forward of that piece, and the protrusion of a portion of the gut, proportioned always to the size of the wound; the pressure from behind keeping that piece protruded, so that it is with difficulty that you can push it back with your finger; this incessant pressure is an absolute security against the access of air. The intestine comes out, not like water out of a bottle, the place of which must be supplied by air entering into the bottle in proportion as the water comes out, but the gut is pushed down by the action of the muscular walls of the abdomen, and that action follows the intestine and keeps it down, and prevents all access to the air, whether the gut continue thus protruding, or whether it be reduced; for if it be reduced, the walls of the abdomen yield, allowing it to be thrust back, but admitting no air. Those who want to know the effect of air, diffused within the cavity of the abdomen, must make other experiments than merely cutting open pigs' bellies;—they must give us a fair case, without this unnecessary wound. We will not allow them to say, when they cut open the belly of any creature with a long incision, that the inflammation arises from the air. Much less shall we allow them to say, when they open the belly with a smaller incision, that, by that little incision, the air gets into the abdomen, or that all the bowels are exposed to the air. They must not cut open the bellies of their animals; they must merely puncture them, and then blow them up.

But this reasoning goes still further; for it proves that air can have no access to the cavity of any abscess, which is contiguous with the abdomen; for the continual motion of the walls of the abdomen, with the continual motion and pressure of the bowels, will keep the walls of such abscess in continual contact with each other, except in so far as they are dilated and separated by matter formed within the abscess, or by foul air generated along with that matter. I am sure Mr. Abernethy will pardon my mentioning his book here, since I do it in no unfriendly way: he should have gone a point farther than he has ventured to do; he might have denied, upon the soundest principles, that the air has ever access to the cavity of a lumbar abscess; for the air cannot enter such an abscess, while it lies, as it does, deep in the cavity of the abdomen, under the weight of all the viscera, and continually pressed in the motion of its muscles; nothing could fill a lumbar abscess with air, but actually inflating it from the orifice at the groin*.

This effect, also, I would number up along with all the other consequences of the continual and universal pressure within the cavity of the abdomen. It is this pressure which gives a continual and gentle motion to the viscera, continual support to them in their several offices, and a protection to their loose and turgid blood-vessels, without which they would burst. When the bowels are wounded, this pressure throws out the fæces, and keeps up the intestines close to the wound. When the veins or arteries are wounded, it prevents the blood spreading in the abdomen, confining it in particular sacs, and forming clots close round the wounded vessels. It is this universal pressure, also, which, when the belly only is wounded (and not the bowels) prevents the access of air; so that air does not enter, even to fill up the room of the very piece of intestine which is forced through the wound. And this perhaps, among others, is one cause why Hydatids, which are generated by the bursting of the pregnant ones, do not fall downwards in the abdomen, from the upper parts where they are commonly lodged, but are found more commonly on the liver, and sticking about the higher regions of the abdomen; while there is but one instance, I believe, of a Hydatid having gotten down into the pelvis, betwixt the rectum and the bladder, so as to choke the bladder and cause a suppression of urine which proved fatal.

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* Any person, at all acquainted with the economy of respiration, will have observed, that I have marked this in a particular manner; that though the pressure and relaxation is indeed alternate, with regard to the lungs, it is continual and unremitting with regard to the abdominal viscera, and all the parts connected with the abdomen, which are as much pressed during expiration, as during inspiration.

Perhaps this doctrine about the admission of air, and its dangerous effects, has been allowed to pass unquestioned for its father's sake, that having been hitherto granted on his authority which I shall be so adventurous as to deny, viz. " That air is a fluid so acrid and stimulating, that, being admitted into a shut sac, nothing can equal its terrible effects."

That the vulgar should believe the first superficial impression that strikes them, of air hurting a wound or sore, is by no means surprising; but it is not natural that men, bred to philosophy, should allow so strange an assertion as this, without some kind of proof; that the air which we breathe, and which we feel upon the surface so bland and delightful, should have so opposite a relation to the internal parts, that it should there be a stimulus more acrid and more dangerous than the urine or bile—is not to be believed upon slight grounds. I do affirm, that it remains to be proved that this fluid, which seems so bland and pleasant to all our senses, and to the outward surface, is yet a horrible stimulus, when admitted, as a celebrated author grandly expresses it, "into the deep recesses of our body*."—"This stimulant power of the air is the reason," says he, "why I have always inculcated in my lectures, but, most especially, since that period (viz. the year 1771)†, the advantages which would attend the exclusion of the air from the deep recesses of the body, in performing different operations, and in treating wounds accidentally inflicted." That all this is not impossible in nature, we must acknowledge; but the author from whom I quote will, I am sure, forgive me for saying it is not proved; for I am entitled to say, that it is not proved; and, from the following observations, I am even inclined to believe, that the doctrine is absolutely false, and all the conclusions from it dangerous and quite wrong.

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* Vide Munro's Bursæ Mucosæ.

† One man is known by one quality or failing, another by another manner. Heister is remarked for sober systematic writing, after the right German fashion; Petit for good sense, and sound and careful observation; and Garengeot for tales like that about the soldier's nose. The author from whom I have quoted the above passage will be easily known by his attention to dates, about which he makes himself, and every body around him, quite miserable, while the lookers on can hardly understand the meaning of it.

The air, for instance, escapes from the lungs in a fractured rib, and first goes abroad into the thorax; then into the cellular substance; then the emphysematous tumor appears; but often, without any scarifications, with very little care or assistance on our part, the air is absorbed, the tumor disappears, and without inflammation of the chest, or any particular danger, the man gets well. Here, then, is the air within the cavity of a shut sac, filling the thorax, and oppressing the lungs, without any dangerous inflammation ensuing.

That the air may be pushed under the cellular substance over all the body, without causing inflammation, is very plain from the more desperate cases of emphysema, where the patients, after living eight or ten days, have died, not from inflammation, but from oppression merely, the body being so crammed with air, that even the eye-balls have, upon dissection, been found as tense as blown bladders. We have also many ludicrous cases of this kind, which prove this to our perfect satisfaction. Soldiers, or sailors, sometimes touch the scrotum with a lancet, introduce a blow-pipe, and blow it up to an enormous size, imitating herniæ, by which they hope to escape from the service. The old story of a man, who was so wicked as to make a hole in his child's head, and blow it up, that he might show the child in the streets of Paris for a monster, is well authenticated; and I have little doubt, that a fellow who knew how to do this, would blow it up every morning, and squeeze it out when he put the child to bed at night. Some villanous butchers, having a grudge at a soldier, found him lying drunk under a hedge; they made a little hole in his neck, and blew him up till he was like a bladder; or, as Doctor Hunter describes the disease of emphysema, "like a stuffed skin."

The common operation of hernia (if the being exposed to air were really the chief cause of danger) is one which, in all honesty and good faith, we should give up altogether; for it consists in opening the sac, handling the intestines, dilating the ring, and returning the bowels into the abdomen. As soon as we open the sac, we can prognosticate the fate of our patient; if the intestine be inflamed, he is not safe; if it be dark-coloured, or livid, he is in imminent danger; if it be of a sound and natural colour, he is, in some degree, safe; and the patient living so often after the intestines have been thus exposed, is a sure proof that they are but little hurt by this exposure to the air.

Bland as air is, when applied to the surface, and harmless as it now appears to be, though blown with a continual motion into what I am well entitled to call the "deep recesses of the body;" yet one author is so extravagant as to tell us, that it is not the incision for lithotomy, no, nor the pulling out of the stone, nor all the cruelties of that horrid operation, that kills the patient, but that a great share of the danger arises from the action of the air*; as if air, bland as it is, could stimulate the urinary bladder, which is both accustomed to bear the acrimony of the urine, and to bear it with ease, insomuch that it is stimulated rather by the quantity than by the quality of what it holds; the bladder, too, which is so far from having any high degree of sensibility, that we can inject our alkaline water into it with but little distress to the patient.

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* "There likewise seems to be strong reason for supposing that the danger, not only in the high but in the lateral operation of lithotomy, may be lessened, by the surgeon using every means to exclude the air from the wound and bladder during these operations, and by stitching the integuments after the high operation."—Munro's Bursæ Mucosæ.

Though "it is, no doubt, the nature of an hypothesis, when once a man has conceived it, that it assimilates every thing to itself as proper nourishment; and from the first moment of your begetting it, it generally grows the stronger by every thing you see, hear, read, or understand;" yet this natural facility, which every man, but most especially every medical man, should be willing to acknowledge, is but a poor apology for carrying an unproved doctrine, like this, such extravagant lengths; and driving with it, full career, into the midst of surgical practice, reforming, or at least changing, the manner of every great operation. The catalogue of operations which have undergone this reformation is curiously drawn out by an author of very high character, after the following manner:—"A, Openings into the knee joint. B, The trepan. C, Emphysema and empyema. D, Openings into the pericardium. E, Wounds of the abdomen. F, Cæsarean section. G, Lithotomy. H, The operation for hernia of the groin or thigh."

These are the operations which have been put upon the new establishment; and from some of these new operations I shall give short extracts, chiefly, in order that it may be known, that however ill this slight refutation may be managed, the arguments and innovations proposed upon the other side are puerile beyond all conception.

B, or the improved operation of the trepan, is this:—"That the surgeon shall desist from sawing, when the innermost lamella becomes thin; and then shall break it up with the levator or forceps*." Here there are three points to be proved, before the improvement can be acknowledged or received; that the breaking up the bone, as we punch out an old tooth, will prevent air getting in, or will prevent harm to the dura mater; and also, that there are surgeons so ignorant, and so rash in an operation which requires no kind of haste, as to drive their trepans through the dura mater, and of course into the brain; or it must be proved, that after cutting up the depressed piece of skull, the air will get into the brain, which we know well it cannot do; for the instant that the pressure of the skull, which preserved the balance, is taken off, the brain rises; and if the dura mater be entire, this rising makes the dura mater, in every case that I have seen, as tense as a drum, and makes it bulge so through the trepan hole, that it is in danger of being cut upon the edges of it; if the dura mater be cut, then the brain itself protrudes. Or, lastly, it must be proved that air is the cause of the fatal inflammation; which it will not be easy to accomplish, nor very wise in any sober man to attempt; for inflammation often comes on where there is no fracture, where no air is admitted, because no operation is performed.

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* "In the operation of the trepan, I have advised, that the cranium should not be entirely cut with the saw; but that the operator should desist from sawing, when the innermost lamella becomes so thin, that it can be easily broken off with a levator, or forceps, by which we not only avoid the danger of the instrument pressing rudely on the brain, but also, in many cases, the cutting of the dura mater, and admission of the air to the surface of the brain, which experiments I made on half a dozen pigs, near thirty years ago."—Monro's Bursæ Mucosæ.

The true causes of inflammation are these:—There is first the terrible blow; there is a crushing and fracture of the bones; there is that hurt of the dura mater, which is inseparable from a fracture of the bones of the cranium; and there is a piece of the skull cut out with the trepan, which, when it is separated from the dura mater, leaves that membrane bleeding at a thousand small points; all the little arteries passing betwixt the dura mater and the skull being torn. We must forget that there are any such accidents as these in our operation, before we can ascribe the inflammation to the admission of air.

But even granting the value and high importance of this improvement, how little credit the author of it, as he calls himself, should have, may be understood by the following translation from Hippocrates: "Nor is the perforation to penetrate entirely into the cranium, lest the dura mater should receive some injury, either from the instrument, or from a long exposure to the air. To avoid this last inconvenience, by which it is often putrified and destroyed, the piece of bone within the terebra should be suffered to remain till it comes off of itself*."

C. "In the case of air infused into the cavity of the thorax, it is advised that the operation should be performed with a small trocar †; instead of which cautious method," says this author, "Hewson and others, following him, have proposed an incision by a knife, which I have found, even in experiments upon sound animals, generally proves fatal from the degree of inflammation which the free admission of the cold air creates." But let it be remembered, that the author keeps the canula still in the thorax, and plugs it with a cork to preserve an outlet for the air; by which it is very plain, that he expects the lungs to fill the thorax with air, from time to time during the cure; so that if there come no inflammation in any such case, it will not be from the want of air. He has told us, also, that small incisions or punctures are safe, though made with the intention of giving vent to confined air, and though kept open to let the air out from time to time, while large incisions cause high inflammation. I confess that these two conclusions seem perfectly natural; it is natural that if the incision were small, the thorax should be free of inflammation, although full of air; and again it will naturally happen, that where the incisions are large, the breast must inflame. In short, it is plain that inflammation, or the absence of it, arises not

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* Riollay's Hippocrates, p. 63.

† "In the case of air effused into the cavity of the pleura, for which, so far back as M,DCC,LVIII, I ventured to propose the paracentesis of the thorax, I have advised that the operation should be performed with a small trocar passed cautiously in a slanting direction; and after withdrawing the stilette, and letting out the effused air, that a flexible canula, with a plug fitted to it, should be introduced, in order to preserve an outlet to the air till the wound of the lungs be closed; and that, before withdrawing the canula, any air remaining in the pleura shall be sucked out with a syringe or elastic

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bottle. And in M,DCC,LXIX a case occurred, in which, by my direction, that operation was performed nearly in this manner, with relief and success. (See an account of this case communicated by Mr. Kellie, one of the surgeons present, to Dr. Duncan, and published by him in his Medical Commentaries, Vol. II. p. 427.)

"Instead of the cautious method above mentioned, Mr. Hewson, (Med. Observ. London, M,DCC,LXVII, p. 396), and others following him, have proposed an incision by a knife; which I have found, even in experiments on sound animals, generally proves fatal, from the violent degree of inflammation which the free admission of the cold air creates." In one experiment on a pig, the inflammation from the admission of air by a small incision was so violent as to kill the animal, after producing an adhesion of the lungs with the upper part of the pleura, in the space of thirty-six hours. See Monro's Bursæ Mucosæ.

from the presence or absence of the air, but from the length of the incision; there is no inflammation where the wound is small, though it be made on account of confined air; there is inflammation where the incisions are large, though they are made with the intention, and also with the effect of letting loose the confined air. There is only one thing to be wondered at, viz. that this canula, fixed so carefully in the thorax, was not at least as effectual in exciting inflammation as even the largest incision; how the pigs or men escaped inflammation I cannot conceive.

D. Points to cases where the air bursting out from the alimentary canal inflamed the abdomen; and the cases are three in number. In the first case, the arch of the colon had been eroded by a tedious dysentery. In the second case, two holes were formed in the jejunum, by two pins, with their points turned different ways, and tied together with a thread, which had been accidentally swallowed. In the third case, of a person in a typhus, the colon seemed to have burst, during the operation of an emetic. This is the whole and full account of these cases, as delivered by the author. A tedious dysentery, with an erosion of the colon—pins tied cross-ways, and sticking firm in the intestines—and the arch of the colon burst, and pouring out its contents, its foul air, fæces, and all, into the cavity of the belly—are curious examples of air causing inflammation. And I must say, that the physician has known little of practice who has not seen patients die in dysentery, without the gut being eroded, or who has not seen emetics in typhus do the business, without any bursting of the colon.

E. That inflammation is, after the operation of

Cæsarean section, the most frequent cause of death, it is neither hard for us to acknowledge, nor at all difficult to explain. The very directions which the author gives, imply at once a tediousness and a rudeness in the operation, which must cause inflammation of the belly, an accident which is but too apt to happen, even when the operation is performed in the most gentle manner. The directions which the author gives for the operation, are to cut, first, through the skin, then through the muscles, then through the arteries, then to plunge the hand at once into the womb, to get out the child; again, to get out the placenta; still a third time, to dilate the orifice of the womb; and after these dreadful incisions, and all this tedious work, he tells us, very calmly, that the inflammation arises from the air. Doctor Aitken put the finishing hand to this joke, when, in his book on the Principles of Surgery, he advised that we should perform the Cæsarean section under the cover of a warm bath, the woman lying under water to exclude the air. This, though it may seem to be a scurvy piece of wit, was really proposed in sober serious earnest.

The admission of atmospheric air as a stimulus, when compared with the great incisions of lithotomy—of hernia—of hydrocele—of Cæsarean section—of the trepan—is no more than the drop of the bucket to the waters of the ocean. And it is just as poor logic to say, that after such desperate operations, these cavities are inflamed by the admission of air, as it would be to say, when a man were run through the pericardium with a red hot poker, that the heart and pericardium were inflamed "by the admission of air." Yet that nothing might be awanting to the absurdity of this doctrine, this, also, is put down among the proofs, in sober serious earnest, according to the following quotation :—

" The danger of the admission of air to the cavity of the pericardium and surface of the heart, is proved by the following very singular case, which occurred to me about six years ago. Two men in liquor, disputing about their skill in fencing, the one challenged the other to a match with pokers heated at the points, that there might be no mistake about the hits, and his challenge was accepted. One of them received a thrust under the cartilage of the fourth rib of the right side, about a finger breadth from the edge of the sternum, in a slanting direction inwards. He complained little till the third day after the accident, when symptoms of deep seated inflammation began to appear, and, notwithstanding bleeding and other remedies, continued to increase. These, on the tenth day thereafter, when I was called to him, were succeeded by rigour and coldness of the extremities, with a small, frequent, and intermitting pulse; and two days thereafter he died. On opening his body, a slanting passage was discovered on the outside of the pleura, into the mediastinum and cavity of the pericardium, in which last, about five ounces of purulent matter were found. The internal part of the pericardium, and the whole surface of the heart, were much inflamed, but there was no mark of injury done to the heart by the point of the poker; and it appeared to me evident, that the fatal symptoms had been chiefly produced by the air entering the pericardium in the time of inspiration*."

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* Munro's Bursæ Mucosæ, page 41.

I believe, that in this case of a man wounded through the pericardium, with a poker "hissing hot," few people will be at any pains to seek for any such out of the way explanation as air admitted through the pericardium; and especially one must be much diverted with the notion of the air being drawn in at every respiration through a deep and slanting wound of the skin, muscles, thorax, and pericardium.

This misfortune of inflammation running so quickly round all the surfaces of shut sacs, wherever they happen to be wounded, proceeds altogether from another cause, simple and plain to the last degree. For, in the wound of any shut cavity where the parts do not adhere, the inflammation spreads and runs its course, by a law of the animal economy which we explain very ill, when we call adhesion the adhesive stage of inflammation, representing, as the first stage of a most dangerous disease, that adhesion which is a natural and healthy action, the most natural in all the system, and the farthest from disease. Thus, in a wound of the breast or belly, in a joint, or in any shut sac, if the parts, being neatly laid together, should once adhere, then there is no swelling, no pain, no formation of matter, the parts are well and sound in the very moment in which they adhere; thus it is sometimes in narrow and slanting wounds. But if the wound be broad and open, or if the least thing keep the lips apart from each other, or if they run into inflammation, then the lips turn away from each other, matter forms, the wound inflames, and not the wound only, but also the wounded cavity inflames; so that if it be in a vital part the man dies. If there be a high inflammation excited in any cavity, be it the thorax and lungs, or be it the cavity of a vein, if the surfaces are kept away from each other, the inflammation may go on, and so prove fatal; but if the surfaces touch each other and adhere, the part is again sound and entire.

Yet here, in describing wounds of the intestines, I have delivered but half the subject. I have still to explain to you wounds of the liver, of the spleen, of the kidney, of the mesenteric vessels, or of the great abdominal veins,—which are easily told; for the inward bleeding, in all these wounds, is the greatest danger; and the bleeding may either be immediately fatal from mere loss of blood, or the blood, exuding in lesser quantities, lies clotted in the abdomen, is as a foreign body there; and thus the inflammation, which is caused by the fæces in wounds of the intestine, is produced by blood, in wounds of the liver or spleen.

This enunciation of these wounds reduces whatever remains to be said to the most perfect simplicity;—divides them into two classes, the wounds with immediate bleeding, and the wounds followed by slow inflammation; and leaves but one thing to interrupt the subject, viz. the condition of the extravasated blood, how it lies in the belly, and by what accident it causes death.

If the liver or vena cava be shot, then there is a dreadful bleeding, which will be immediately fatal; for, after a ball has pierced the liver, the patient sinks, as if the ball had absolutely wounded the great vein itself. The patient feels little pain; he grows pale and cold; he swoons, from the inwar loss of blood; the belly fills with blood, becomes tense and hard; the man languishes in this coldness and fainting for a day, and expires. Often the blood begins to flow from the outward wound; and, whether you permit your patient to bleed thus outwardly, or close the wound, that he may die a more lingering death, makes but a few hours of difference in a wound, which is so surely mortal. A wound of the spleen, liver, or vena cava, is as deadly as a wound of the heart, so full are they of blood.

But the blood may issue from the wound of some less important part; perhaps, it flows from a wound of the mesentery, from the vessels of the stomach, or from a wound of the kidney, or of the emulgent vein. The flow of blood from such vessels as these is slow, and so far safe, being moderated by that resistance and universal pressure which I have lately explained; the blood flows slowly; it is seldom suspected or perceived; clots are formed about the bleeding veins; and the patient slumbers, without pain or apprehension of pain, for many days. But the patient and surgeon are roused from this state of ease and security, by the most pressing symptoms; for, on the fifth or sixth day, the patient becomes uneasy; his belly swells; he begins to vomit; the dreadful pains come on, and the surgeon gives up all for lost, without knowing any possible cause for these alarming symptoms.

But if the surgeon be careful in examining the abdomen, and fix his attention where the patient complains of pain, he will find a tumor there, more distinct than could be expected from such a cause.

The course of these symptoms is very easily explained. The patient slumbers in ease and safety for six days; till then, no tumor, no swelling, no pain, no one sign of danger appears, because the inward bleeding has reduced him to this low and slumbering state, because the blood runs into the abdomen warm and mild, and is not felt as a foreign body. But the blood soon gathering into the form of crassamentum and serum, the serum becomes acrid, the crassamentum lies heavy among the bowels, like a hard cake; the inflammation begins, and this tumor being felt on the fifth or sixth day, the belly inflames on the eighth or ninth; on the tenth day the patient is in extreme danger. There is the dreadful pain, the miserere mei, on the eleventh or twelfth day, the patient, after all the signs of gangrene, expires.

Sometimes the surgeon, notwithstanding the confusion and uncertainty of these signs, adventures to open the tumor, thrust in his finger, and so discharge the blood; and, for his encouragement in this bold operation (where he has so much to answer for), there are cases on record, where the surgeon has cut out two, three, or four pounds of black and coagulated blood, and his patient (after an incision, too, of several inches long) has survived. And a surgeon, moreover, cuts with some degree of security; for the universal pressure of all the bowels prevents the blood from going out wide into the cavity of the abdomen, and collects it into separate clots and tumors of blood lying directly over the wounded vessels, and supported by the turns of the intestines and mesentery, which are immediately below; the blood is not permitted to fall down into the pelvis, but is collected into clots at the wounded part; there, of course, the incisions ought always to be made, by enlarging the wound itself.

I have hitherto dealt only in general principles, and have explained to you the two great dangers, the effusion of the fæces into the cavity of the belly, and the effusion of blood; the former a violent stimulus, exciting sudden inflammation, the latter a slower stimulus, exciting inflammation, after an interval of many days of ease and quiet, often cutting off our patient, when we have no apprehension of danger. I shall refrain from dilating and explaining fully all the other points, which, however it might waste your patience, never could exhaust the subject. I shall rather try to sum up the whole business in aphorisms, reciting briefly the points which are already discussed, and adding, in short rules, the doctrines of such wounds as are not yet explained.

First, Wounds of the liver are mortal; for, considering its nature—how full it is of blood—the cor abdominale, as it has been called, how can there fail to be a profuse bleeding? indeed, the wound of the liver is like the wound of a great vein. No doubt, a ball sometimes passes through the thick substance of the liver, without causing immediate death; or, perhaps, the patient survives, because the great vessels are not wounded; or because the blood flows very slowly from them, and coagulates in the wound;—perhaps, the bruising of the shot deadens the vessels; or, perhaps, the swelling of a penetrating wound, in a substance so soft and spongy as the liver is, closes the sides of the wound, so that the bleeding stops. However this be, we are sure that patients have lived twenty days with wounds fairly across the liver; and sometimes, after wounds where the liver must have been wounded more or less, the patient has recovered.

Yet these are exceptions merely to this general rule: wounds of the liver still are to be declared mortal; there is a great inward bleeding,—the patient immediately sinks and faints, languishes in a slumbering state, insensible almost, and without pain, lies cold and death-like for perhaps twenty-four hours, and then expires.

Second, Wounds of the liver, spleen, or vena cava, are all alike fatal, and the signs of internal bleeding, from any of these, are precisely the same; and when a man dies, from the passing of a chariot-wheel over his body, or is killed in boxing, or after a great fall, is taken up dead; or when a man has been struck in the belly, and killed by a great ball, which has not wounded the skin; in all these (which I consider as parallel cases) the hurt is often found to be in the liver, vena cava, or spleen, or kidney; any of which being burst, pour out so much blood that the patient dies.

Third, Bleedings from wounds of the mesentery, kidney, emulgent vein, or any smaller vessel, are often slow and gentle, and are not known by the common signs of inward bleeding. The patient continues easy, and his belly soft, for some days, till the blood coagulating, either by the weight of its coagula, or by the acrimony of its serum, excites inflammation, so that, on the sixth day, there comes pain, swelling, hardness of the abdomen, quick pulse, fever; at last, the torments of the miserere mei, and then gangrene and death. And here it may be noticed, that if there be immediate fainting on receiving the wound, and then coldness, accompanied with a continued faintness, swelling of the belly, and oppressed breathing, for some days, most likely there is blood, and in dangerous quantity, from some greater vessel. But if the patient have lain easy, and there comes pain, swelling, fever, and other threatening signs, on the sixth or seventh day, with a tumor in one part of the belly, it is most likely a bloody tumor which has begun to excite inflammation, and the blood must be cut out. If there be pain and swelling on the first or second day, it is from wounded intestine; if there be pain and swelling, but not till the sixth day, it is from blood; if there be no pain or swelling till after the fifteenth day, our patient is almost safe.

Fourth, The signs of a wounded stomach are a burning sensation at the pit of the stomach; heat, thirst, and a feverish pulse; great irritability of the stomach, and vomiting so intense, whenever the mildest things are taken down, as to throw the whole frame almost into convulsions; these are the chief signs of a wounded stomach, together with bloody serum thrown up, and blood passing by stool; and, in the end, extreme weakness, faintings, a low quick and fluttering pulse, swelling of the belly and hiccup, and commonly death. Yet often during all this, violence and straining continued for weeks, not one particle of food goes out into the belly; no doubt, it cannot always happen thus, but it often does.

Fifth, When the intestines are wounded, the escaping of the fæces declares but too well the nature of the wound; and too often there comes on an inflammation, not so limited as merely to make the intestine adhere, but diffusing itself over all the belly, whence come knottings and adhesions of the intestines, swelling of the belly, fever, pain, the miserere mei, mortification, and death.

Sixth, Wounds of the bladder are always, or almost always, mortal; for the bladder both discharges its contents by its own contractile power, and lies very low in the pelvis; it throws out its urine into the cavity of the abdomen, which is a fluid so highly stimulating, that inflammation and mortification of the bowels are not long delayed.

Seventh, The wound of the gall bladder is like this —for its fluid is stimulating in a still higher degree, and the patient very seldom escapes the quick and deadly inflammation; the urine or the bile act like poisons thrown into the abdomen; the patient dying a most miserable death.

Thus the prognostic of danger goes downwards, according to the succession of parts; those which are most important in the animal economy being affected in the higher wounds.

Wounds of the liver and spleen are deadly, from the inward bleeding; wounds of the stomach are hardly less mortal, for there is both a bleeding from its numerous vessels, and danger of its food being poured out into the abdomen; there is great danger of inflammation, also, from the mere wound. The wounds of intestines are less dangerous; for though the fæces are sometimes poured out, so that the belly inflames,—though the inflammation, which should heal or unite the intestine to the abdomen, often spreads over all the surfaces, yet they are safer than wounds of the stomach; for the intestines are quick in their inflammation; the peritoneum, by a wise provision of nature, is apt to inflame; there is, at such a time, a sort of sympathy, like a contagion, in the contents of the belly, so that, towards whatever point this wounded intestine is turned, it meets with parts ready to inflame, and thus the wounds of the bowel and of the belly inosculate, and the patient is saved.

The great intestines, lying lower in the abdomen, are less dangerous still; they are bound down in their right place, they are behind the peritoneum, and they lie upon the thick flesh of the lumbar muscles, so that their wounds quickly heal. But still it must not be forgotten, that though neither the liver, spleen, stomach, nor bowels are wounded, inflammation may come on merely from the hurt done to the peritoneum itself; after a wound of the belly, the patient can never be without danger.

There is but one thing more, relating to the prognostic, in these wounds, which you should endeavour to remember, viz. that the stomach, by its sinking, is apt to spill its contents into the belly. The intestines are less apt to do so, for they are held steadier in the abdomen; the urinary bladder discharges into the abdomen, because it is emptied by its own contractile power; the gall bladder must spill its contents when wounded, for there is nothing that can hinder the bile from flowing. The bile is the highest stimulus, the urine next, and the food and the fæces are less irritating, and the blood least of all; and, perhaps, it is according to this order, that the dangers of these wounds should be calculated; effusions of bile being the most dangerous*; wounds of the urinary bladder next to that; wounds of the stomach and bowels come next in order; and effusions of blood are the least dangerous as a cause of inflammation, if only the bleeding be not so profuse as to endanger life.

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* I saw a man die in a very miserable condition, who had, by a fall, torn the gall ducts, so that the abdomen swelled with dreadful pain: the most thorough jaundice I ever saw; and the abdomen, when opened, was full of bile, serum, and coagulable lymph; the intestines universally turgid of a yellow colour; universally inflamed; adhering at some points, and gangrened in others.

Lastly, if the ball remain in the belly, though the patient escape through the first danger, he is never safe; while the ball being lodged about the loins, in the heart of the muscles, causes carious bones, fistulous ulcers, and running of matter, with a hectic fever, (which cannot stop while the ball remains), so that this is a very hopeless case*.

Now, before I lay down the few short rules which relate to the practice, it is my duty to remind you, that we can do but little in the cure,—nature herself cannot do much,—we are as spectators merely, and every recovery is truly an escape.

Surgeons have boldly cut into the stomach, and extracted knives which had fallen down into it; foreign bodies of all kinds have made their way safely through its walls; soldiers have often recovered, whose stomachs had been so wounded with the sabre, that the rice, or barley, or meat, which they had taken at last meal, has been cast out through the wound; and the older surgeons tell us, that in broad wounds of the stomach they had sewed the wound together with many stitches, sewing the wound of the stomach to the external wound. There are not wanting cases where the wound of the stomach having been prudently managed by the modern surgeon, the general pressure has kept the stomach up to the wound, and adhesion has completed the cure; sometimes wounds of the liver have healed; and often the surgeon has cut out safely very large collections of blood; the intestines have so often adhered, without the help of such stitches, that, as I have said, you find anuses at the groin, and miraculous recoveries in every book, and read of cures, till you forget that there are dangers.

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* In opening the body of a young gentleman, who had been wounded in a duel, and who had survived his wound a whole year, lingering in a very sickly condition, till at last he was cut off by a hectic fever, we found the ball (which had passed in at the groin) lodged under the psoas muscle, upon the inner surface of the haunch bone, and surrounded with many sacs of pus.

First, Bleeding from the arm is the great preservative against internal bleeding, and is the only means of preventing inflammation; in every wound of the abdomen you must bleed with a very liberal hand.

Second, Quietness, rest, and opiates, with fomentations to the inflamed belly, are next in importance to bleeding; and the belly must be kept open with gentle glysters, but never with laxative medicines, lest they should purge.

Third, The patient must very resolutely refrain from all food for ten or twelve days; for diet would support the strength, encourage the inflammation, and disturb the wound by a flux of fæces, which might, perhaps, be thrown out into the cavity of the abdomen itself. The patient must refrain from food, then, that the intestines may not be moved. He must be nourished with glysters; or if he takes any thing by the mouth, let it be some jelly or soup, which, though it were to go out into the abdomen, might be absorbed.

Fourth, If the wound be in the belly merely, and a sound intestine be forced out, you must put it back gently with the fingers, and stitch the outward wound.

Fifth, When there is a wounded intestine which you are warned of only by the passing out of the fæces, you must not pretend to search for it, nor put in your finger, nor expect to sew it to the wound; but you may trust that the universal pressure which prevents great effusion of blood, and collects the blood into one place, that very pressure which always causes the wounded bowels and no other to protrude, will make the two wounds, the outward wound, and the inward wound of the intestine, to oppose each other, point to point; and if all be kept thus quiet, though but for one day, so lively is the tendency to inflame, that that adhesion will be begun which is to save the patient's life*.

Sixth, If, indeed, you have a wounded intestine fairly in your hand, protruding and plainly wounded, it were madness to let it go back into the abdomen, where there cannot but be some danger of the fæces getting out. But do not sew the bowel with a long suture, in hopes of closing the breach, nor follow the strange and whimsical inventions of cylinders of paper or of isinglass, which it is easier to use in experiments upon dogs than to practise in real wounds. You must make but one single stitch, and sew the wounded intestine to the outward wound; there the gut will adhere, throw out its fæces for some time, and then heal, the outward and the inward wound uniting in one knot or scar.

Seventh, If a sound bowel have come through a narrow wound, and be so inflamed that you cannot push it back, you must not think of pricking it with a needle or an awl, as was the custom of Paré, Dionis, and all the older surgeons; you must perform the operation of hernia by slipping in your finger to guide the knife, opening the wound a little wider, till the intestine is free, and then stitching the outward wound after the intestine is put back.

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* In Mr. Hunter's book on gunshot wounds, there is a case of a gentleman, who, having been shot through the belly in a duel, died in thirty-six hours; and it was found, upon dissection, that even in that very short period of a day and a half, the adhesions had formed.

You must take all possible pains, both about the surgery of the wound, and in keeping down the actions of the system; for you perceive that there are such chances as make every case interesting and none desperate.

If my reader should wish to know something more than these general principles, or should desire (as we commonly express it) to be more minutely informed, about particular wounds of certain parts contained within the cavity of the abdomen, &c. he may read Mr. Benjamin Bell's chapters upon "Wounds of the Intestines, Wounds of the Stomach," &c. and he may read that chapter upon Wounds of the Uterus, which begins with these words, "The uterus is a strong muscular bag peculiar to the female sex, being solely intended for the fœtus."

ON THE MANNER OF STITCHING AN INTESTINE.

I have endeavoured to represent the real condition of a wounded bowel, and the easy cure of it, in that simple form in which I have conceived it. I have advised that one single stitch only should be struck through the wounded bowel, and then drawn also through the wound. And I have ventured, moreover, to say, that if there is in all surgery a work of supererogation, it is this operation of sewing up a wounded gut. The mechanical and vulgar conceptions of those who believe that a wounded intestine is closed, not by inflammation and the adhesion of contiguous parts, appears to me offensive to a degree which I shall hardly venture to express to you. But it strikes deeper and wider than this; it is not offensive only, it is dangerous: for while I take an interest, and find only a pleasant labour in teaching the young surgeon what is right to do, and what is consistent with the simple ways of nature and the economy of the living body, he is seduced by a formal account of most curious and ingenious methods of sewing a gut, and is drawn aside to follow after such puerile conceits, thinking to do more than even nature can do in such a case. He reads in the system of a celebrated author, that "their opinion is ill founded who would rather trust to nature for the cure of a small opening in the gut, than to insert a ligature, insomuch (says the author) that I would not leave even the smallest opening that could admit either chyle or fæces to pass without stitching it up."

These things cannot be left unsettled, without danger;—they cannot be explained, without explaining and refuting also, wherever it is required, the opinions of authors:—and again, it is impossible to explain those things, without allowing such expressions to escape, as are often more dangerous to the man who uses them, than to the man who suffers them; and which no generous mind can think of using without regret. Yet, what shall we say of a man, who adventures to write on a learned profession, while he is himself totally ignorant; who writes boldly through the whole circle of the human body; of wounds which he has never seen, and of viscera which he has never handled; who supplies his want of knowledge by bold conjectures only; who tells us, "that when the spleen is laid bare by a wound, it is easily discovered, whether it is wounded or not; that a division (i. e. a wound) of the duct of the pancreas will, by interrupting or impeding digestion, do much injury to the constitution; and as the liquor *will* be effused into the cavity of the abdomen, it may thus *be productive* of *collections*, the *removal* of which may require the ultimate assistance of surgery: That wounds of the receptaculum chyli will be distinguished by the discharge of a milky liquor, and that they can never become the objects of surgery;—but by producing collections in the abdomen, which may require to be discharged: That the discharge from the receptaculum chyli is altogether white like chyle, or mixed with a considerable portion of it; and that the patient becomes daily weaker than he ought to do from a wound of the same size in any other part, owing to the nutritive part of the food being carried off before any advantage is derived from it*?" Who tells us, concerning the mesentery, "That in its wounds the discharge of *chyle* or blood into the cavity of the abdomen is what we have most to dread; and that whenever any portion of the mesentery is protruded, it should be examined with accuracy;—and whenever any of its vessels are found to be divided, they should be tied with ligatures," &c.? As for "wounds of the liver, they are apt, we are told, to prove particularly hazardous, from their allowing the bile, which is very soon rendered putrid, to be poured into the cavity of the abdomen." "And wounds of the gall-bladder are more dangerous, only as they are more certainly *productive* of extravasations of bile into the abdomen."

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* "With a view," says this author, "to prevent the diameter of the canal from being distended, which, at the same time, will lessen the extent of the wound, the patient should be kept upon a very spare and cooling diet. Any food, which he takes, should be not at regular meals," &c. &c. Is not the accuracy and carefulness of observations, such as these, especially meritorious, since they are all concerning things which the author has never seen,—never heard,—never read of,—cannot understand? Since this same receptaculum chyli is nothing, it is only a name which the older anatomists used, before they knew the part rightly; and now they find, that there is no such thing as a receptaculum, or bag.

These observations are unparalleled in all the books of surgery, from the invention of printing to this present day. The author talks of the spleen laid bare, as if it were some fixed viscus, or one which could be seen, while it absolutely lies among the deepest in the abdomen, and cannot be drawn out into view, even in the dissection of a dead body, without thrusting down the hand for it;—he talks of the pancreas as if it could be hurt without a most complicated and absolutely fatal wound;—of the thoracic duct as if it could be hurt, without a wound of the aorta, heart, or spinal marrow;—and of the receptaculum chyli as if it were a part really existing, while it is merely a name, used ignorantly by the older anatomists, and forgotten now; and he not only describes how the patient survives such wounds, but how gradually he wastes, and what means the surgeon is to use for his recovery:—he talks as if the pancreatic duct could fill the abdomen with its saliva, or as if the thoracic duct could fill it with chyle;—as if the mesentery could really protrude by itself. These things lying all now before me, in one single chapter, have inclined me, most uncharitably, to call it a curious specimen of the art and mystery of writing surgery (and anatomy to boot) by conjecture and mere guess;—these grosser faults have, at least, weaned me thoroughly from that kind of prepossession, which some people indulge in favour of every thing that is in print;—and this, in its turn, will enable me to speak confidently about the remaining errors in this chapter, upon wounds of the viscera; for once more I affirm, that it is impossible for the young surgeon to receive willingly, or to follow confidently, this simple method of sewing an intestine, which I commend, while other methods appearing to him more curious, more ingenious, or more secure, are left unrefuted.

This author first directs us to learn what is, according to his system, a thing very essentially necessary to be known, viz. which is the upper, and which is the lower end of the gut:—"For it is necessary, in reuniting the intestines, to know which is the upper end; but it requires some attention to make the distinction. The peristaltic motion will be observed to be more remarkable in the upper division than in the under. But the most certain method is, to observe at which of the ends the fæces or chyle are evacuated," &c. &c.

There are some little things wanting in this explanation; for the author should have told us, in the first place, how much of each end of the intestine must be hanging out in this easy negligent fashion, before we can compare the peristaltic motion of the upper end with that of the lower;—must we learn to know, at one glance of the eye, whether the peristaltic motion be fast or slow? and whether it be such as belongs to the upper end of the intestine? how or in what animals, and by what kind of experiments, shall we learn this? has this author ever seen peristaltic motion thus regular?—has he ever seen chyle, so that he could swear to it, that it was chyle?—can he pronounce, from which hand the fæces and flatus come in an accidental anus at the groin? Now, my reason for asking these questions is a very humble one, viz. that I never saw chyle in the intestines (in the delicate vessels, the lacteals, indeed, it is easily seen). I have hardly seen this peristaltic motion, even in animals, when opened on purpose, and positively never in the human body;—and when I have chanced to see an anus at the groin, I never could distinguish whether the fæces and froth, and flatus, which issued from it, came from the right hand or from the left;—they came from the general opening.

However, it must be acknowledged, that this author really has good reason to be careful about this matter; for his operation, which proceeds upon it, is a very desperate one: he advises the surgeon to seek out the upper end of the intestine, or the end that may be wanting, not only by putting in his fingers, but by cutting up the wound! "I am clear," says he, "however, that this (viz. the putting one stitch into the end of a wounded intestine, so as to hold it in contact with the outward wound) will not prove satisfactory to the feelings of any practitioner, possessed of that degree of fortitude which our art requires, and who has that regard for the safety of his patient, which every surgeon ought to possess. And, although I have advised in wounds of the intestines, when no part of them protrude, where we cannot, therefore, know whether the wound be large, or only a small puncture, and where the injured part may be so situated, that it could not be reached, without opening the greatest part of the abdomen, and turning out perhaps the whole alimentary canal, that we had better allow the patient to have the chance of recovering, without any attempt to make a discovery, and which he may do if the wound is small, than to propose a measure, which, of itself, might be attended with more hazard than the injury for which it was meant to be a remedy; yet, when we are rendered certain of the gut being completely divided, by one end of it hanging out of the wound, as this will give much cause to imagine, that the other is at no great distance, I think it ought, by all means, to be searched for, by enlarging the external wound, so as to admit of the fingers of the operator being freely inserted. Even where the upper part of the gut is protruded, it is worth while to submit to this inquiry, merely in order to have at least some chance of avoiding the loathsome inconvenience of an artificial opening for the fæces: and, where the upper part of the gut has slipped in, the patient can have no chance for farther existence, if it be not discovered. In such a situation, therefore, we should not hesitate as to the measures." I will not, as I have formerly professed, quarrel with this author about many trifling faults, which I rather choose that my reader should have all the merit of discovering, without being beholden to me; but I cannot refrain from saying, that this is not the prudent way of addressing young men, who are but too apt to do adventurous things upon slight authority. But this is not all; other curious improvements follow close upon the heels of this important discovery; for, as soon as the surgeon has found out the upper end of the gut, he is to thrust the upper end of the gut within the lower end, an inch or two, just as he would push in the sliding end of an opera-glass; and that the ends may go neatly within each other, a roll of isinglass or tallow is to be put into the gut; and that they may remain unmoved for some time, they are to be well and soundly sewed with a good needle and thread all round. Indeed, to read this, any sensible man must believe, that I spoke in mere ridicule, and described this firm sewing of the gut dishonestly;—but I shall, as usual, give the quotation, —let the author speak for himself:—"In this situation, it would be difficult to draw the divided parts together with a needle and ligature, without hurting the opposite sides of the gut, in any other way than by keeping it extended by means of some round body inserted into it. For this purpose, it has been proposed to make use of a tube of thin pasteboard or paper; but as this might be laid hold of, and kept firm by the ligature, a small roll of tallow is preferable, as it will afterwards melt and pass easily off with the fæces. A piece of it, nearly equal to the diameter of the intestine, should be inserted into the end of the upper portion of the gut, and, being afterwards passed into the other, so as to carry the one to the extent of an inch, or thereby, fairly into the other, the two portions should now be stitched together with a small needle, armed with a fine thread. The stitches should be carried completely round the gut; and in order to give them as great a chance as possible of succeeding, they might even go twice round! first, at the edge of the under-portion of gut! and afterwards about an inch beneath, near to where the upper part of it terminates!"

From all which it is very plain, that the mechanical notions of this author are utterly incorrect;—that he has no conception how a gut adheres, nor how that adhesion may be assisted by a single stitch, nor how impossible it must be for a gut to adhere, or to do any thing indeed but mortify, by being stitched all round, and stitched even with a double row. That a man, who has no conception of a gut being sure in any other way than by the firmness of his own stitches, should propose a double row of stitches, is not wonderful; he should just have put a binding round it, and so finished this admirable operation.

Now, I do affirm, that the carefulness and apparent accuracy of all this, has irresistible weight with a student, especially when enforced and repeated in every different form; while, in fact, this way of distinguishing the upper from the lower end of a gut, —this thrusting of the fingers into the belly,—this cutting up of the wound, in order to grope for that end of the gut which is wanting,—this sewing it upon a cushion of tallow, and the sewing it fast and firm with a double seam, is, like the rest of the chapter, delivered upon conjecture merely;—it is an untried experiment as yet, and let it be tried when it may, I shall venture to predict, that it will turn out a very sad one *.

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* This author adds one more speculative direction, which is of the most singular nature, and has, as far as I know, all the merit that originality can give it, that is, having sewed the gut tightly, which he never fails to do, he advises, in the following passage, that the ligatures be cut off, and the gut with the seam in it, and the thread be thrust back into the abdomen, and no more said about it. "In this manner," says he, "the sides of the wound may be drawn closely and exactly together, without lessening the diameter of the gut in any degree; and the end of the ligature may at last be secured, and cut off close to the other extremity of the wound, if the gut is to be put freely into the abdomen, or it may be left of a sufficient length to hang out at the wound in the teguments, if it is the meaning of the operator to retain the wounded part of the intestine in contact with the external opening. This, indeed, is usually done, that we may have it in our power, as it is said, to draw away the

I shall now return, then, to represent once more the simple mechanism of this case. As for intestines cut fairly across in all their circle, I believe the thing cannot happen, and that this, like the rest, is a piece of mere guess work; for, if I know any thing about the way, in which the viscera are disposed within the belly, it must happen, that a sabre which cuts one piece of intestine fairly across, must have cut many other turns half through; and, in short, that a sabre cannot cut a piece of intestine across, unless the stroke have cut up much of the belly, so much, that whether you finish with a double row of stitches, or whether you use or neglect the elegant invention of the roll of tallow, is a matter of very little importance; but only that you had just as well spare yourself the trouble, and let the poor man alone.

The wound, slit-like in one side of intestine, is the thing which chiefly you have to do with. I have shown already, that such a wound is to be cured, not by the edges of the wound adhering to each other, for they are like mere mathematical lines, having no breadth of surface and no broad contact;—the lips of such a wound are healed, not by adhering to each other alone, but by adhering at once to each other, and to the inner surface of the abdomen. I have

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ligature, on the wound of the gut being cured. It is probable, however, whatever suture may be employed, if more than one or two stitches have been passed, that it will be very difficult, and even uncertain, our getting the ligature away, without hurting the intestines more than we ought to do. I would never advise, therefore, with any view of this kind, that the ligature should be left out at the wound; less danger will arise from cutting it entirely away, and allowing the stitches to remain. A considerable part of it will fall into the cavity of the gut; and in such circumstances, the danger of the patient, from other causes, is so great, that any additional risk, that can occur from the remaining part of it, must be so trifling, as not to deserve notice."—Benjamin Bell's System of Surgery.

proved by reasoning, that the surrounding parts of the abdomen are at such time highly sensible, much inclined to inflame, and ready to unite with them; and I have confirmed this, by showing, that in one singular example, five desperate wounds in one person healed: and there each wounded intestine adhered to some part of the peritoneum, or some other piece of gut in various ways. I have thus proved, that the mere pressure upon the viscera will keep the wounded gut so close to the peritoneum, as to make it unite. But since it is plain, that the outward wound is the part of the abdominal surface, the best inclined to sympathise and adhere with the wounded intestine, our duty plainly is, to make one simple stitch very slightly through the edges of the wounded intestine, not with the absurd intention of sewing up the breach in the intestine firmly with a needle and thread, but merely to keep the inward wound of the intestine neatly and closely in contact with the outward wound, when it will adhere,—will continue perhaps open, and throwing out its fæces for some time,—but will contract gradually as the outward wound contracts, and will close effectually and soundly before the outward wound heals.

But if it should happen that a gut is cut fairly across in all its circle, which it is not impossible, but it may be, by a stab with a knife or broad sword, the mechanism of the case is this: the mesentery still has its hold upon each end of the divided intestine; and the two ends of the intestine can never be far separated from each other; nor can the one end be introduced so far within the other as to make the double row of stitches round and round, the one row distant from the other an inch. It is not by this thorough stitching that such a gut is to become sound; it is only by adhesions, and by two adhesions taking place at the same moment. The two ends of the gut may be made to adhere to each other; and the prudent way of favouring these adhesions is to introduce the one piece of intestine a little way within the other, and make one single small stitch in that part of the circle which is farthest from the mesentery, and then draw the gut by means of that thread close up to the wound, and thus it will probably happen, that the mesentery will keep its side of the circle firm, that the stitch will keep the opposite side firm, that the gut being drawn by the thread, and pushed from behind, and flattened by the universal pressure within the abdomen, the double adhesion may take place, viz. of the surfaces of the intestine to each other, and of the wound of the intestine to that part of the inner surface of the belly where it is open and inflamed by the outward wound.

Whether I have explained this simple process rightly, will be best judged of by those who are the best acquainted with the facts of surgery, as they now stand; and the method which is here proposed must be authenticated or refuted by future observations.

END OF VOL. I.

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OBSERVATIONS

ON THE

INJURIES OF THE SPINE,

AND OF

THE THIGH BONE.

IN TWO LECTURES,

DELIVERED AT THE SCHOOL IN GREAT WINDMILL-STREET,

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